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OF
BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

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NEWS AND NOTES

Resignation of the Permanent Secretary for Non-Medical Microbiology. Dr. R. S. Breed, Permanent Secretary for Non-Medical Bacteriology has submitted his resignation to the International Committee on Bacteriological Nomenclature to become effective January 1, 1952. The Permanent Secretary is also ex-officio a member of the Judicial Commission and of the Board of Editors of the International Bulletin of Bacteriological Nomenclature and Taxonomy. The Chairman of the International Committee, Dr. A. J. Kluyver on behalf of the Committee, has accepted the resignation with reluctance. Dr. Breed states that other duties, particularly his increasing burden of responsibilities as the Chairman of the Editorial Board of the Bergey Manual of Determinative Bacteriology, have made continuance of his service as one of the Permanent Secretaries impracticable.

Dr. Breed was appointed a Permanent Secretary of the International Committee at the first Congress of the International Association of Microbiologists held in Paris in 1930. He has served in this position for more than twenty-one years. Much of the constructive work done in the development of the International Bacteriological Code of Nomenclature has been the result of his efforts. He has been most active in the stimulation of interest in the fields of bacteriological nomenclature and taxonomy, and has made many notable contributions in these fields.

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CLASSIFICATION AND NOMENCLATURE OF ENTEROBACTERIACEAE

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In the classification and nomenclature of the Enterobacteriaceae two different concepts exist, to which we will refer arbitrarily as the biochemical classification and as the classification by antigenic analysis, although serologic methods enter into the former and biochemical methods into the latter.

1. Biochemical Classification

In the biochemical classification, as typified in the 4th edition of Bergey's Manual, only biochemical methods were used to distinguish species. It should be said that a gradual development of serologic methods had occurred through the years and that workers relied on these methods to distinguish types within certain genera. For example, various serologically distinct types were known in the genus Salmonella, and these were recognized by agglutination and agglutinin absorption tests. Yet in formal classifications only a biochemical key was used to distinguish species.

That this practice has persisted to the present day is shown by the treatment of the genus Escherichia in the 6th edition of Bergey's Manual. Three species are recognized, as follows:

Species	Citrate Utilization	H_2S Production
Escherichia coli	-	-
Escherichia freundii	+	+
Escherichia intermedia	+	-

The above illustrated treatment of the genus Escherichia represents a retreat from former editions of the manual in which elaborate biochemical keys were employed and a much larger number of species was recognized. From this it is obvious that the editors felt that it was not profitable to delineate a large number of ill-defined types based upon biochemical characteristics which had no real significance. It is obvious also that the three above-mentioned species are, in fact, large groups or subgenera since they are composed of many biochemical and serologic types. In the classification of the bacteria by methods such as those outlined, the elementary units of which the species are constituted cannot be distinguished as they are by the practical use

of antigenic analysis. If, for example, one wishes to determine the occurrence of a particular culture of E. coli in infantile enteritis, it is impossible to do so by biochemical methods since such methods serve to distinguish only the species of Escherichia, each of which makes up a large group of distinct antigenic types. Even though all biochemical methods which are presently employed are applied to the study of such cultures, only biochemical groups, each composed of numerous antigenic types, can be delineated. Such a system will not answer the present needs of the scientific worker, of the clinical bacteriologist, nor of the epidemiologist.

2. Classification by Antigenic Analysis

While great reliance had been placed in serologic tests for many years, the era of antigenic analysis in the Enterobacteriaceae may be said to have begun with the pioneer work of Bruce White which has been confirmed, refined, and extended by many workers. As in the older method of classification, the bacteria are divided by biochemical methods into groups comparable to the recognized genera. These groups are further divided into O-groups and serotypes through the recognition of their constituent antigens by serologic methods which have been proven to be reliable and to yield comparable results in the hands of many persons. The criticism often has been made that persons interested in antigenic analysis have failed to employ biochemical methods which would differentiate types or species. Such criticisms are not justified since all biochemical methods which have been found to yield valuable information regularly are employed in the work. After the division of the groups into O-groups on the basis of their heat stable somatic antigens, the organisms are divided into serotypes through recognition of their K (capsule or envelope) and H (flagellar) antigens. In some instances these serotypes are divided further on the basis of their biochemical properties or by their reactions to standard bacteriophages.

This division into types and subtypes is necessary to determine the epidemiological relationships of biochemically similar cultures, to investigate the pathogenic significance of individual types, and to obtain a clear picture of the composition of the genera and of the family.

As regards the separation of the family into groups or genera, it must be emphasized that no sharply defined groups exist in nature. Still, for practical purposes, it is desirable to divide the family into several groups. This can be done by biochemical methods, although such groups must be established arbitrarily and it must be kept in mind that many cultures which are studied will not conform to any of these arbitrarily defined groups. Further division of the groups should be done by serologic study of the bacteria.

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Each of the groups or genera is composed of hundreds of serologic types, which from a practical standpoint are constant and which can be quickly and accurately recognized by serologic methods. It is not necessary to designate all these serotypes by special names nor to regard them as species. It is sufficient to number them or, better still, to give their antigenic formulas. These types form the elementary units established by the methods employed and are the basis of antigenic classification. It is sufficient to designate the O-groups into which the types fall with capital letters (as in the case of the genus Salmonella) or by arabic numerals. The alphabet does not contain sufficient letters to designate all the O-groups of some of the groups. For example, in the Escherichia group more than 120 O-groups now are recognized. From the foregoing it is obvious that we have two entirely different systems with which we must deal. The first of these, the biochemical classification, is a purely taxonomic concept and can be considered only as a convenience for the purposes of the orderly classification of bacteria in which each family must be divided into tribes and each tribe into genera and in which each genus must have a type species. On the contrary, the antigenic classification fulfills the needs of the scientist who is studying the phylogeny and evolution of bacteria as well as the needs of the clinical laboratory and of the epidemiologist. The two systems are in no way comparable and should not be used for the same purposes.

The question naturally arises as to whether these two systems may be correlated and whether it is possible to erect an antigenic classification. To a certain extent it is possible to do this, although it is necessary to include some groups not hitherto used in conventional classifications. It is obvious also that the groups at present recognized do not include all of the diverse strains of the enteric bacteria. Any proposed grouping must be based only on existing knowledge with the realization that further groups probably will be added. Further, it is quite possible that some groups delineated at present will be merged. With the present state of knowledge, the characterization of enteric bacteria must of necessity remain in a somewhat fluid state.

It is not believed that O-groups or serotypes constitute species. Probably species should be established at the level of the biochemically defined subgroups or subgenera. Thus each species would be made up of numerous serotypes defined by serologic analysis. To designate species at this level should cause no difficulty in any of the groups other than Salmonella. Fortunately, such serotypes as have been recognized in groups other than Salmonella have been designated only by laboratory numbers or by antigenic formulas. Examples of such labeling are Proteus X 2 and X 19 and Coli 1:1:7. In such cases the designation of biochemical species presents no problem.

Unfortunately, in the case of the Salmonella group, serotypes that

were distinguished many years ago have been labeled as species, e.g. S. bovismorbificans, S. typhimurium, etc. Here we encounter the conflict between traditional usage and developing knowledge. It is now known that it is impossible to distinguish the various serotypes by biochemical methods, and such biochemical keys as have been proposed for the genus have no basis in fact. Therefore, we are left with two alternatives: (1) To state that species in the genus Salmonella cannot be defined, or (2) to propose a very simple biochemical key which will serve to distinguish the accepted type species (S. choleraesuis, S. typhi, and S. kauffmannii. Since these three species were differentiated by serologic methods and not by biochemical methods, it appears that the classification is not valid from a taxonomic standpoint. Therefore, if species are to be established in the genus the following method seems to be the least illogical:

Salmonella

Species	Arabinose	Trehalose	Gas Production
Salmonella choleraesuis	-	-	+
Salmonella typhi	-*	+.	-
Salmonella enterica	+ or -	+**	+**

-= negative, + = promptly positive, * = rarely positive, ** = rarely negative

The term S. kauffmannii of Borman, Stuart, and Wheeler is rejected since it was not biochemically defined. In its place is substituted S. enterica which is biochemically defined. The result is, for all practical purposes, the same as that proposed by Borman et al. The genus, then, is divided into two biochemically defined serotypes which respectively represent the type species and the best known member of the genus, and into a large group of serotypes which cannot be biochemically differentiated one from another.

To give an idea how such a biochemical classification would look, we present a short draft in Table 1. Keys for the differentiation of groups and species are given in Tables 2 and 3. We do not recommend such a classification, but we would agree that a classification similar to that given below could be used side by side with an antigenic classification, but only with the realization that the biochemical classification was to be used for purely taxonomic purposes.

It should be emphasized that the opinions expressed herein are only the views of the writers and should not be taken as expressing the opinions of others. The terms used in the biochemical classification may or may not be valid ones and should be subjected to review by persons familiar with bacterial taxonomy.

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Table 1.

Biochemical Classification
(For taxonomic purposes)

Genus or Group	Species	
1. Salmonella	1. Salmonella choleraesuis 2. Salmonella typhi 3. Salmonella enterica	
2. Arizona	1. Arizona arizonae	eventually combined into one genus ?
3. Bethesda	1. Bethesda ballerupensis	
4. Escherichia	1. Escherichia coli	eventually combined into one genus ?(1)
5. Klebsiella	1. Klebsiella pneumoniae (or aerogenes) 2. Klebsiella rhinoscleromatis	
6. Shigella	1. Shigella dysenteriae 2. Shigella flexneri-boydii 3. Shigella sonnei	
7. Providencia	1. Providencia providenciae	
8. Proteus	1. Proteus hauseri a. var. vulgaris b. var. mirabilis 2. Proteus morganii 3. Proteus rettgeri	

(1) If it is decided by the Nomenclature Committee that the generic name Bacterium is to be used, then the Escherichia and Klebsiella groups should be combined in one genus and called respectively Bacterium coli and Bacterium aerogenes.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

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Table 2.

Biochemical Differentiation of Groups

(Typical behaviour of most important types)

	Mannitol	Lactose	Indole	Gelatin	H_2S	Urea*	Gas	Motility
Salmonella	+	-	-	-	v	-	v	v
Arizona	+	+ or x	-	+	+	-	+	+
Bethesda	+	+ or x	-	-	+	- or x	+	+
Escherichia	+	+	+	-	-	-	+	v
Klebsiella	+	+	-	-	-	x	+	-
Shigella	v	- or x	v	-	-	-	-	-
Providencia	- or x	-	+	-	-	-	v	+
Proteus	v	-	v	v	v	+	v	+

* = Urea read after 6 hrs. incubation
\+ = Promptly positive
x = Late and irregularly positive or negative
\- = Negative
v = Variable

Table 3.

Biochemical Differentiation of Species

Klebsiella Species	Ammonium Citrate	Urea	Gas Production
Klebsiella pneumoniae	+**	x	+**
Klebsiella rhinoscleromatis	-	-	-

Shigella Species	Mannitol	Lactose
Shigella dysenteriae	-	-
Shigella flexneri-boydii	+**	-
Shigella sonnei	+	-+

Proteus Species	Mannitol	Maltose	Indole	Gelatin
Proteus hauseri var. vulgaris	-	+	+	+
Proteus hauseri var. mirabilis	-	-	-	+
Proteus morganii	-	-	+	-
Proteus rettgeri	+	-	+	-

+** = rarely negative, -+ = delayed positive, x = late and irregularly positive or negative.

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Addendum - It is realized that no provision is made in the above classification for the motile forms at present classified as Aerobacter, nor of the forms classified by Borman, Stuart and Wheeler as Paracolobactrum aerogenoides. It is felt that present knowledge of these forms is insufficient to justify their placement in a definite group. It is not clear whether the genus Klebsiella should be expanded to embrace these forms or whether the definition of the genus Escherichia should be modified to allow their inclusion.

Acknowledgement - The writers are indebted to Dr. S. T. Cowan for reviewing and criticizing the manuscript.

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BACTERIOLOGICAL NOMENCLATURE
AND TAXONOMY
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THE GENERIC NAMES MÜLLERINA AND DREPANOSPIRA IN BACTERIOLOGY

Preliminary Statement. File No. 52.

The Judicial Commission has been requested to issue an OPINION relative to the status of the bacterial generic names Müllerina and Drepanospira. Müllerina was first given by de Petschenko, but not used in his later published description in which the name Drepanospira was proposed.

Müllerina de Petschenko 1910 (1). This author described a parasitic infection of the protozoan Paramecium caudatum caused by a spiral organism. No name was given to the parasite in the text of the article, but in a footnote the author states:-
"Le microorganisme en jeu est un unicellulaire rassemblant au spirille. Je lui ai donné le nom Müllerina paramecii et l'étude de son cycle evolutif, que j'ai faîte, paraîtra sans tarder ailleurs (Arch.f. Protistenkunde)."

Drepanospira mülleri de Petschenko 1911 (2). In this second article the author proposes a different generic and specific name, Drepanospira mülleri and gives a detailed description. In a footnote he states:-
"Le processus detaille de l'infection dans la culture est decrit par moi dans un autre travail ....Ce microorganisme y est denommé par moi Müllerina paramecii."

The name Müllerina paramecii was proposed by de Petschenko before the name Drepanospira mülleri. The question of the validity of publication of each of the names requires examination. Rule 12 of the International Bacteriological Code of Nomenclature states that the name of any taxon not validly published is "without standing" in nomenclature.

Valid publication of a name (Rules 11 and 12 International Bacteriological Code of Nomenclature) must meet the following specifications.

1. The name must have been effectively published, that is, the publication in which the name appears must have been sold or distributed as printed matter to the general public or to bacteriological institutions. This specification seems to have been met by the author through publication in standard journals.

2. The name must be accompanied by a description af the taxonomic group (taxon) or by a reference to a previously and effectively published description of it. While there is some description of the organism in de

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Petschenko's first article in which the name Müllerina paramecii is proposed, most of the article is concerned with a description of the pathology of the infection. That the article was not intended to include a description of the organism is evident from the footnote in which the name was proposed. It states that a study which had been made of the growth cycle would be published elsewhere promptly. In his second article the author in a footnote states that the details of the infection were described previously. The inference that the author did not intend to describe the organism in the 1910 article is clear. Doubt may be expressed therefore as to the valid publication of the name Müllerina paramecii.

3. Rule 12 also provides that: "A name of a taxonomic group is validly published only if it has been definitely accepted by the author who published it. A name proposed provisionally in anticipation of the eventual acceptation of the group or mentioned only incidentally is not validly published."

The species name Müllerina paramecii was first mentioned incidentally in a footnote as the name of a microorganism to be later described. When the description was later published the older name was definitely not accepted by the author, and the generic name Drepanospira and the species name Drepanospira mülleri were definitely proposed.

Draft Proposal. The generic name Müllerina de Petschenko 1910 and the species name Müllerina paramecii de Petschenko 1911 were (were not) validly published and are with (without) standing in nomenclature.

Note. Recommendations 27c and 27d of the International Bacteriological Code of Nomenclature provide that generic names and specific epithets taken from the names of persons that include the Germanic ü should be spelled with ue. Hence the first generic name Müllerina de Petschenko should be spelled Muellerina, and the species name later proposed as Drepanospira mülleri should be spelled Drepanospira muelleri.

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BACTERIOLOGICAL NOMENCLATURE
AND TAXONOMY
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"I GENERI E LE SPECIE DELLE BATTERIACEE" 1889 WITH BIBLIOGRAPHY OF TREVISAN'S PUBLICATIONS ON SYSTEMATIC BACTERIOLOGY

File No. 56

Between the years 1842 and 1890 Count Trevisan published numerous contributions to systematic bacteriology. He reviewed with diligence the literature of his day and made notable contributions to bacteriological nomenclature and taxonomy. Unfortunately several important papers were published in media not readily accessible; their contents are not generally known. In 1889 appeared a brochure "I generi e le specie delle Batteriacee" in which Trevisan outlined his classification of the bacteria and proposed many new names of species, genera and higher taxa. The taxonomy and nomenclature of this publication were followed in the main in DeToni and Trevisan's treatise "Schizomycetaceae," included in Saccardo's Sylloge Fungorum Vol. 9 (1889) in which more than a thousand species were described.

Careful inquiry has failed to locate any original copy of "I generi" in the United States, although three libraries have photostatic copies, taken from photostats secured from a Florence, Italy, library by Dr. and Mrs. R.S. Breed, who made a special search for the original. The importance of this treatise in the solution of problems in nomenclature of bacteria and its present relative unavailability to researchers make desirable its reproduction. Many of the names proposed by Trevisan are in common use at present, others have been ignored. Inadequate descriptions in other cases may make some names unavailable. The evaluation and appropriate disposition of these names is one of the more important and vexing problems in the nomenclature of the bacteria, and international agreement as to appropriate status of many of the names seems advisable. A photographic reproduction of the pages of "I generi" has therefore been included (pp. 11 to 44) in this BULLETIN.

Following is a list of the several publications of Trevisan of significance in bacteriological nomenclature and taxonomy.

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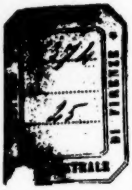

TTORE TREVISAN

I GENERI E LE SPECIE DELLE BATTERIACEE

MILANO
1889

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I GENERI E LE SPECIE

DELLE

BATTERIACEE

PRODROMO SINOTTICO

PER IL CONTE

VITTORE TREVISAN DI SAINT-LÉON.

MILANO
TIPO-LIT. L. ZANABONI E GABUZZI
Via Fontana, N. 12 e 14

1889.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

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Non vi ha alcuno che ignori quanto sia grande « le gâchis », come Duclaux lo chiamò, il garbuglio in cui attualmente si trovano la classificazione e la nomenclatura dei batteri. Il problema dell'invariabilità della forma, affacciantesi in generale per tutti gli esseri viventi, rispetto ai batteri riceveva due soluzioni differentissime.

Due scuole sorsero. Per Ferdinando Cohn, che pel primo si provò di darne nel 1872 una classificazione sistematica, la costanza della forma nei batteri è assoluta. La classificazione di Cohn era appena venuta in luce che si è trovata alle prese con un'altra teoria diametralmente opposta, accolta e sostenuta sopratutto da Nägeli. Per esso, la forma dei batteri è variabilissima; ogni specie può, secondo le condizioni del mezzo, assumere ogni forma, da quella di Micrococco a quella di Spirillo. Per esso forma e funzione specifica non esistono; forma e funzione variano egualmente secondo le condizioni esterne. « Lo « stesso batterio, trapiantato in mezzi differenti, può successi- « vamente, nel corso delle sue generazioni, produrre qui l'aci- « dità del latte o la fermentazione butirrica, o l'alterazione dei « vini, o la putrefazione delle sostanze albuminoidi, o la distru- « zione dell'urea..... e là generare la difteria o il tifo, o la feb- « bre ricorrente, o il cholèra..... (*) »

(*) *Nägeli*, Die niederen Pilze. Munich, 1877.

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Affetta dalla nascita da vizi di origine, da grosse cause di errore, dall'avere ritenuto estensibile a tutti in generale i batterî un'unica men retta osservazione sopra un'unica essenza batterica, dalla mancanza di esperimenti conseguente dall'aver creduto « impossibile di fare sicuramente culture pure coi « batterî tanto a causa della loro estrema piccolezza, quanto « della loro disseminazione generale nell'aria e nell'acqua (*) », la teoria dello sconfinato polimorfismo dei batterî naufragò. Oggidì la grandissima maggioranza degli autori ammette, in principio, che una specie può talvolta, in date condizioni, assumere temporariamente forme anormali, delle forme d'involuzione, se così meglio piace chiamarle, forme che d'altronde si allontanano di poco da una forma costante e definitiva che termina sempre per predominare e che serve a caratterizzare la specie. E ciò ammesso, i batterî rientrano nella legge universale per cui i caratteri morfologici servono di base a tutte le classificazioni degli esseri organici.

Infrattanto, in parte pure per la ognor più rapida successione delle scoperte di nuove forme, in parte, per quanto si riferisce ai batterî che si andavano mano a mano rinvenendo nelle malattie dell uomo o degli animali, per la invalsa inclinazione di dare, senza più profonde ricerche e più larghi esperimenti, al batterio osservato il nome della malattia in cui era stato veduto e della quale talora troppo facilmente era stato ritenuto l'agente specifico, le tradizioni della classica nomenclatura linneana si smarrivano per via; e così avvenne che a gran numero di specie di batterî non mai fosse imposto il latino binomio scientifico. Di certo non era a desiderare che la nomenclatura avesse a marciare più speditamente della scienza; ma nulla di più necessario che col progresso della scienza abbia a procedere di pari passo il progredire della nomenclatura; come nulla al presente di più ovvio che risentire ogni dì più imperioso il bisogno di rintracciare un filo conduttore che nella confusione delle lingue aiuti ad uscire al più presto dai mali passi.

Da anni io andava pazientemente accumulando osservazioni e materiali per un libro in cui si trovassero raccolte e sistematicamente coordinate tutte le forme specifiche batteriacee, e

(*) *Nägeli*, Das Mikroskop, 2ª edizione, 1877, pag. 644.

ne esponesse e discutesse i caratteri morfologici, biologici, chimici, le peculiari proprietà, tutto quanto, in una parola, se ne fosse risaputo intorno ad esse considerate dal punto di vista essenzialmente botanico, relegando in seconda linea, più concisamente esposte, le complesse e spesso tanto controverse questioni attinenti alla etiologia delle malattie in cui si affermò che i batteri abbiano o realmente hanno parte. Or mentre il lavoro n'era pressochè ultimato, essendo apparso quell'aureo volume *Die Mikroorganismen* del Flügge, in cui questo sì poderoso e sì competente campione avrebbe agevolmente potuto del pari eccellere nella delimitazione e nel coordinamento dei generi, parvemi opportuno soprassedere alquanto.

Oggidì, mentre era sul punto di consegnare al tipografo il manoscritto arricchito delle posteriori osservazioni e delle nuove aggiunte che tuttogiorno si vanno facendo al novero già ragguardevole delle forme specifiche conosciute, sursemi nell'animo il dubbio se fosse per avventura più opportuno differire di alcuni pochi mesi la stampa dell'opera onde farla precedere dalla pubblicazione di un riassunto bastevole a far riconoscere le ommissioni che eventualmente fossero occorse.

Dal minor numero possibile delle quali ommissioni dipendendo in buona parte l'utilità di un lavoro siffatto, queste brevi pagine non hanno appunto altro scopo che quello di presentare a chiunque scoperse, descrisse o illustrò una qualche nuova specie o forma batteriacea di cui non vedesse fatta parola in codesto Prodromo, *le più vive preghiere di volere cortesemente indicarmi in quale opera o giornale ne avvenne la pubblicazione,* tanto più grato se possibilmente volesse spingere la cortesia sino a trasmettere, anche verso eventuale pagamento, con sollecito mezzo postale una copia dell estratto tirato a parte del relativo libro, o una copia dell'opuscolo o del numero del giornale. Di ogni addizione, rettifica o miglioria qualunque indicata, sarà, come di dovere, religiosamente fatto cenno nell'opera.

Quanto alla classificazione, non potendo questo essere il luogo di sviluppi più ampi di quelli che in più scritti già diedi, ho dovuto limitarmi alla più breve indicazione possibile dei caratteri più essenziali. Del resto, è chiaro che una coordinazione sistematica in tutte parti soddisfacente non potrà essere rag-

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giunta se non quando si avrà acquistata quella completa conoscenza delle singole specie che per buon numero delle quali è al presente un pio desiderio. Ad onta di ciò, il lettore troverà qui per la prima volta metodicamente disposte 510 specie, ripartite in 44 generi, numeri ben superiori del doppio, del triplo, del quadruplo delle specie annoverate nei lavori di Zopf, di Flügge, di ogni altro.

Milano, Aprile 1889.

V. Trevisan.

BATTERIACEE

(W. R. Mac Nab, Journal of Botany, Vol. VI, 1877, p. 340)

Sottordine I. **TRICOGENE** Trev. (1885). — Tre stati di sviluppo vegetativo: 1. Filamenti; 2. Baculi; 3. Cocchi. Filamenti (stato primario, iniziale, archetipo) ora rivestiti di vagina propria ambiente, ora non vaginati, per lo più forniti di base distinta dalla estremità superiore, affissi o irradianti da un punto centrale, di rado liberi colle due estremità perfettamente eguali. Baculi e cocchi provenienti dai filamenti.

Trib. I. **CLADOTRICEE** Trev. (1879) — Pseudoramose.

Gen. I. CLADOTHRIX F. Cohn (1875) — Vagine distinte.
1. **Cl. dichotoma** F. Cohn (1875).

Gen. II. SPHAEROTILUS Kützing (1833) — Vagine distinte.
1. **Sph. natans** Kützing (Linnaea VIII, p. 385).

Gen. III. NOCARDIA Trev. — Cladothrix senza vagine.
1. **N. farcinica** Trev. (Bacillus de la maladie des boeufs de la Guadeloupe connue sous le nom de Farcin *Nocard*, 1888).
2. **N. Actinomyces** Trev. (Actinomyces bovis *Hartz*; Discomyces bovis *Rivolta*, 1884; Bacterium actinocladothrix *Afanassjew*, 1888).

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3. **N. Försteri** Trev. (Streptothrix Försteri *F. Cohn*, 1875).
4. **N. arborescens** Trev. (Bacillus arborescens *Edington*, 1887).
5. **N. ferruginea** Trev. (Bakterium bei Chorea St. Viti mit Pilzbildungen in der Pia mater *Naunyn*, 1888).

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Trib. II. **LEPTOTRICHIEE** Trev. (1885) — Semplici.

Gen. IV. CRENOTHRIX F. Cohn (1870) — Vagine distinte.

1. **Cr. Kühniana** Giard, 1882 (Leptothrix Kühniana *Rabenh.*, 1853: Crenothrix polyspora *F. Cohn*, 1870).

Gen. V. LEPTOTRICHIA Trev. (Batteri italiani, p. 14, 1879) — Leptonema *Rabenh.* (1857), non *Leptonema* A. Jussieu, 1824 (Euforbiacee), nè *Leptonema* Hooker, 1844 (Crucifere); Leptothrix *F. Cohn* (1875), non *Leptothrix* Kützing, 1843 (Alghe); Thiothrix *Winogradsky* (1888) — Vagine distinte.

A — *Idrobie.*

1. **L. spissa** Trev. (Leptothrix spissa *Rabenhorst*).
2. **L. radians** Trev. (Leptothrix radians *Kützing*).
3. **L. rigidula** Trev., 1879 (Leptothrix rigidula *Kützing*).
4. **L. parasitica** Trev., 1879 (Leptothrix parasitica *Kützing*).
5. **L. ochracea** Trev. (Leptothrix ochracea *Kützing*).
6. **L. lutea** Trev. (Leptothrix lutea *Kützing*).
7. **L. dubia** Trev. (Leptothrix dubia *Nägeli*).
8. **L. nivea** Trev. (Leptonema niveum *Rabenhorst*).
9. **L. tenuis** Trev. (Thiothrix tenuis *Winogradsky*).
10. **L. tenuissima** Trev. (Thiothrix tenuissima *Winogradsky*).

B — *Zoobie.*

11. **L. gigantea** Trev. (Leptothrix gigantea *W. Miller*).
12. **L. maxima** Trev. (Leptothrix maxima buccalis *W. Miller*).
13. **L. buccalis** Trev., 1879 (Leptothrix buccalis *Robin* et *Lebert*).
14. **L. variabilis** Trev. (Leptothrix variabilis *Rasmussen*).

Gen. VI. PHRAGMIDIOTHRIX Engler (1882) — Vagine nulle.

1. **Phr. multiseptata** Engler (Bot. Ver. der Pr. Brandenburg, p. 19).

Gen. VII. BEGGIATOA Trev. (Prospetto della Flora Euganea, p. 56, 1842) — Leucothrix *Oersted* (1844) — Vagine nulle.

1. **B. Mucor** Trev., 1879 (Leucothrix Mucor *Oersted*).
2. **B. Lanugo** Thuret, 1863 (Leptomitus Lanugo *Agardh*).
3. **B. mirabilis** F. Cohn (in Hedwigia 1865).
4. **B. arachnoidea** Rabenhorst (B. versatilis *Trev.*, 1845).
5. **B. pellucida** F. Cohn (in Hedwigia 1865).
6. **B. iridescens** Menegh., 1846 (Oscillaria iridescens *Kützing*).
7. **B. tigrina** Rabenhorst (Oscillaria tigrina *Römer*).
8. **B. alba** Trev., 1845 (B. punctata *Trev.*, 1842; B. Rainieriana *Menegh.*, 1846; B. dulcis *Menegh.*, 1849).
9. **B. Cohnii** Trev. (B. alba var. marina *F. Cohn*, 1865).
10. **B. leptomitiformis** Trev. (Prosp. della Flor. Eug., p. 56, 1842).
11. **B. minima** Warming (1875).

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12. **B? Meyeniana** Trev. (Oscillatoria *Meyen*, Reise u. d. Erde, I, p. 55).

Gen. VIII. KURTHIA Trev. (Caratteri di alcuni nuovi generi di Batteriacee, p. 3, 1885) — Vagine nulle.

La specie che elevai a tipo di questo genere appartiene indubbiamente alle Batteriacee Trichogene, e non già alle Baculogene. Presenta un ciclo evolutivo con tre stati morfologici ben distinti: 1. Stato iniziale filamentoso; 2. Stato dissociato baculigeno; 3. Stato coccoide zoogleico. I filamenti giovanissimi, più o meno rettilinei, immobili, a misura che crescono divengono ognor più ondulati ed infine si aggrovigliano completamente con prevalenza di forme più o meno regolarmente spirali. La costituzione dei filamenti varia del pari coll'età. Sul principio il protoplasma del filamento sembra omogeneo e non interrotto da un'estremità all'altra; ben presto si distinguono delle fine strie trasversali, primi indizi dei diafragmi che si formano. Mano a mano che lo sviluppo progredisce, il protoplasma si segmenta in articoli che danno luogo a baculi arrotondati alle estremità, separati gli uni dagli altri da intervalli vie e vie più pronunciati. Bentosto, al luogo dei filamenti indivisi delle prime ore di età, non si trovano più che dei monili di baculi. La temnogenesi continua attivissima ed i macrobaculi, segmentandosi sempre più, finiscono con decomporsi in microbaculi appena un poco più lunghi che larghi, da ultimo globulosi, formanti stormi zoogleici, e sporiferi.

1. **K. Zopfii** Trev., 1885 (Bacterium Zopfii *Kurth*, 1883).

Gen. IX. BILLETIA Trev. — Kurthia sporifera con vagine distinte.

1. **B. Laminariae** Trev. (Bacterium Laminariae *Billet*, Comptes rendus de l'Académie des sciences de Paris, Tome CVI, séance du 23 Janvier 1888, p. 293).

Presenta lo stessissimo ciclo evolutivo coi tre stati morfologici di *Kurthia Zopfii*, da cui differisce per la presenza di vagine proprie ambienti, a quel modo che le Leptotrichie si distinguono dalle Beggiatoe.

Sottordine II. **BACULOGENE** Trev. (1885) — Tre stati di sviluppo vegetativo: 1. Baculi; 2. Filamenti; 3. Cocchi. Baculi (stato primario, iniziale, archetipo) da cui hanno origine filamenti e cocchi. Filamenti (stato secondario transitorio) non mai rivestiti di vagina propria ambiente, non mai forniti di base distinta dall'altra estremità, non mai affissi o irradianti da un punto centrale, risultanti o da un prolungamento indefinito di un unico baculo o da più baculi rimasti in congiunzione per incompleta temnogenesi trasversale.

Mentre nelle Batteriacee Tricogene l'individuo autonomo è rappresentato dal filamento da cui trae origine ogni organo di moltiplicazione o di propagazione capace di riprodurre nuove generazioni, nelle Baculogene il filamento non è che uno stato casuale affatto indipendente dalle condizioni necessarie alla vita autonoma individuale. Nelle Tricogene ogni organo di propagazione o di moltiplicazione sempre riproduce direttamente un filamento, solo dal quale ha principio costantemente il ciclo evolutivo; nelle Baculogene invece ogni organo di propagazione o di moltiplicazione sempre

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12

riproduce un baculo da cui costantemente incomincia il ciclo del proprio sviluppo specifico.

Trib. III. **BACILLEE** Trev. (1887) — Baculi, filamenti e cocchi non mai racchiusi in capsule membranaceo-gelatinose.

Gen. X. PASTEURIA Metschnikoff (1888).

1. **P. ramosa** Metschnikoff (Annal. Inst. Pasteur, N. 4, p. 165).

Gen. XI. WINOGRADSKYA Trev.

Baculi cilindrici e filamenti aggregati in famiglie zoogleiche ripetutamente ramose, rivestite di tenue membrana gelatinosa. Spore ignote.

1. **W. ramigera** Trev. (Zoogloea ramigera *Itzigsohn*, 1867).

Dopo averla ripetutamente a lungo coltivata ho dovuto convincermi che nulla affatto ha di comune con *Cladothrix dichotoma*, che è specie del tutto autonoma, che non saprebbesi riferire ad alcun altro genere.

Gen. XII. THIODICTYON Winogradsky (1888).

1. **Th. elegans** Winogradsky (Beitr. I, p. 82. tav. III, fig. 13-17).

Gen. XIII. MANTEGAZZAEA Trev. (Batteri italiani, p. 13, 1879) — Rhabdomonas *F. Cohn* (1875); Rhabdochromatium *Winogradsky* (1888).

Baculi fusiformi con protoplasma uniformemente diffuso. Spore ignote.

1. **M. Winogradskyi** Trev. (Rhabdochromatium fusiforme *Winogr.*).
2. **M. rosea** Trev. (Rhabdomonas rosea *F. Cohn*, 1875).
3. **M. minor** Trev. (Rhabdochromatium minus *Winogradsky*).
4. **M. fusiformis** Trev. (Bacterium fusiforme *Warming*, 1875).
5. **M. Cienkowskii** Trev. (Batteri italiani, p. 22).

Gen. XIV. BACILLUS Trev. — Metallacter e Chromatium *Perty* (1852); Bacteridium *Davaine* (1863); Bacillus e Bacterium *F. Cohn* (1873); Streptobacteria *Billroth* (1874); Pollendera *Trev.* (1884); Coccobacillus *Lehe* (1885); Proteus *Hauser* (1885); Bacteriopsis *Trev.* (1885); Coccothrix *Lutz* (1886); Sclerothrix *Metschnikoff* (1888).

Baculi cilindrici, cilindracei o ellissoidi, con protoplasma uniformemente diffuso. Spore microsome (*) provenienti in baculi normali immutati.

§ 1. Bacilli zoobii patogeni in malattie contagiose.

Bacilli endogeni in malattie contagiose dell'uomo.

A — *Nessun sviluppo sulla gelatina a circa 22°* (Coccothrix *Lutz*).

1. **B. tuberculosis** R. Koch (Sclerothrix Kochii *Metschnikoff*).
2. **B. lupi** (« La Tuberculosis cutis deve clinicamente essere distinta dal Lupus. Non è dimostrato che il Bacillo trovato nel Lupus sia veramente il Bacillo della tuberculosi. Coll'innesto non riescì mai sinora di riprodurre il Lupus. » *Schwimmer, Kaposi, Finger*).

(*) Cioè che non mai raggiungono un diametro maggiore del diametro trasversale normale dei baculi entro cui si formano.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

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3. **B. leprae** Ann. Hansen (1877).
4. **B. Innesi** Trev. (Bacille de l'éléphantiasis des Arabes *Innes*, 1887).
5. **B. aegyptius** Trev. (Bacillo della congiuntivite catarrale degli Egiziani *R. Koch*).

B — *Liquefa la gelatina.*

6. **B. beribericus** Trev. (Caratt. di alc. nuov. gen. di Batt., p. 12, 1885).

C — *Non liquefa la gelatina.*

7. **B. Afanassieffi** Trev. (Bacillus tussis convulsivae *Afanasieff*, 1887).

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8. **B. porri** Trev. (Bacterium porri *Majocchi*).
   ** Bacilli esogeni in malattie miasmatico-contagiose dell'uomo.
9. **B. amarillae** (*) Trev. (Bacille de la fièvre jaune *Babes — Corn.* et *Bab.*, Bacter., p. 529, fig. 248 *b*).
   *** Bacilli in malattie contagiose che l'uomo può contrarre dagli animali.
10. **B. anthracis** (**) F. Cohn (Pollendera anthracis *Trev.*, 1884).
11. **B. mallei** Zopf (Bacillus ozenae *Trev.*, 1884).
12. **B. Mottei** Trev. (Bacillo della rabbia *Motte* e *Protopopoff*, 1887).
    **** Bacilli in malattie contagiose degli animali.
13. **B. Grawitzi** Trev. (Batterio dell'acne contagiosa del cavallo *Dieckerhoff* e *Grawitz*, 1885).
14. **B. Perronciti** Trev. (Bacillo della pneumonite nodulare dei vitellini *Perroncito*, 1882).
15. **B. diphtheriae-vitulorum** Flügge (Mikroorgan., p. 265).
16. **B. agnorum** Trev. (Bacterium subtile agnorum *Rivolta*, 1881).
17. **B. Thuillieri** Trev. (Bacillus des Schweinerothlaufs *Flügge*).
18. **B. Charrini** Trev. (Bacille de la pseudo-tuberculose bacillaire du cobaye *Charrin* et *Roger* 1888).
19. **B. mustelaecida** Trev. (Bacillus der Kaninchenseuche *Eberth* und *Schimmelbusch*, 1883).
20. **B. diphtheriae-columborum** Flügge (Mikroorgan., p. 263).

§ 2. Bacilli zoobii patogeni in malattie non contagiose.

* Bacilli in malattie non contagiose dell'uomo.

A — *Dell'apparato circolatorio.*

21. **B. Tricomi** Trev. (Bacillo della gangraena senilis *Tricomi*, 1886).
22. **B. gigas** Trev., 1885 (Streptobacteria gigas-pericardii *Billroth*).
23. **B. strumitis** Tavel (1889).
24. **B. heminecrobiophilus** *Arloing*, 1888.

(*) « Febre amarilla » degli Spagnuoli.

(**) Serafini, alcuni mesi fa, affermò che il Bacillo del carbonchio possiede una capsula due volte più larga del baculo, con limiti chiarissimi e ben determinati, affatto simile alla capsula della *Klebsiella Friedländeri*, non visibile coi processi ordinari di colorazione ma bensì benissimo col metodo di Friedländer per la colorazione di questa Klebsiella, e che, del pari che in essa, svanisce nelle culture. Ciò stando, il *Bacillus anthracis* apparterrebbe egualmente a *Klebsiella*.

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14

B — *Dei reni e delle urine pàlogene.*

25. **B. nephriticus** Trev. (Bacille de la néphrite bactérienne *Babes — Corn.* et *Bab.*, Bactér., p. 373, fig. 197-198).
26. **B. chyluriae** Trev., 1885 (Bacillus of Chyluria *Alb. Wilson*, 1884).
27. **B. gliscrogenus** Trev. (Bacterium gliscrogenum *Malerba* e *Sanna-Salaris*, 1888).
28. **B. Cladoi** Trev. (Bacille pedunculé *Clado*, 1887).
29. **B. cystiformis** Trev. (Bacille cystiforme *Clado*, 1887).

C — *Della pelle.*

30. **B. Demmei** Trev. (Bacillus des Erythema nodosum *Demme*, 1888).
31. **B. eczemicus** Trev. (Bacillo dell'eczema).
32. **B. Lassari** Trev. (Bacillus des Lichen ruber *Lassar*).

D — *Dell'apparato digerente.*

33. **B. Lingardi** Trev. (Bacillo della stomatite ulcerosa *Lingard* e *Bart*).
34. **B. Klebsii** Trev., 1885 (Bacillus typhosus *Klebs*, 1881) — Bacillo della necrosi intestinale.
35. **B. dysentericus** Trev. (Bacillus der Dysenterie *Klebs*, 1887).
36. **B. Lesagei** Trev. (Bacille de la diarrhée verte des enfants du premier age *Lesage*, 1887).
** Bacilli in malattie naturali non contagiose degli animali.
37. **B. felis** Trev. (Cocco-bacterium felis *Rivolta*) — Batterio della pleurite infettiva del gatto.
38. **B. agilis** Trev. (Bacillus pneumonicus agilis *Flügge*).
39. **B. Galtieri** Trev. (Microbe pathogène chromo-aromatique du porc *Galtier*, 1888).
*** Bacilli in malattie sperimentali non contagiose degli animali.
40. **B. necrophorus** Flügge (*Löffler*, Mitth. d. K. Ges. Amt., II, p. 493).
41. **B. famiger** Trev. (Bacillus bei Erysipel am Kaninchenohr *Flügge*).
42. **B. necans** Trev. (Bacille consécutif au charbon *Babes — Corn.* et *Bab.*, Bactér., p. 231).

§ 3. **Bacilli normalmente viventi innocui nell'uomo o negli animali.**
* In organi varii dell'uomo.

A — *Nessun sviluppo sulla gelatina.*

43. **B. smegmatis** Trev. (Bacille du smegma preputialis *Alvarez* et *Tavel*, 1885 — *Corn.* et *Bab.*, Bacter., p. 780, fig. 347).
44. **B. telmatis** Trev. (Bacillus saprogenes N. 2. *Rosenbach*).

B — *Liquefano la gelatina.*

45. **B. Bizzozerianus** Trev. (Bacillus epidermidis *Bizzozero* e *Bordoni-Uffreduzzi*, Fortschritte der Medicin, 1886, N. 5; Carcinombacillus *Scheurlen*, 1887). — È impossibile conservare il volgare nome *Bacillo del cancro* a questo batterio che non può essere riconosciuto in alcun modo siccome agente specifico del carcinoma, ma unicamente dev'essere considerato come un saprofito affatto innocuo, rinvenuto in tant'altre malattie e in persone assolutamente sane, ospite abituale dell'epidermide dei capezzoli normali di giovanette e donne sanissime.

46. **B. sudaminis** Trev. (B. scarlatinae *Edington*, 1887) — Rinvenuto in uomini sanissimi, nulla autorizza a credere che si trovi in rapporto colla etiologia della scarlattina.

C — *Non liquefano la gelatina.*

47. **B. exapatus** Trev. (Bacillus der Conjunctivalsack *f*, *Fick*, 1887) — Osservato ripetutamente in occhi sanissimi.
48. **B. fulvus** Edington (1887).

** Nell'apparato digerente.

A — *Nella bocca dell'uomo.*

49. **B. Rasmusseni** Trev. (Leptothrix I *Rasmussen*, 1883; Bacteriopsis Rasmusseni *Trev.*, 1885).
50. **B. buccalis** Trev. (B. maximus buccalis *W. Miller*).

B — *Nel ventricolo dell'uomo.*

51. **B. geniculatus** De Bary.

C — *Nel muco intestinale normale.*

α — *Dell'uomo.*

52. **B. anceps** Trev. (Bacille du mucus intestinal normal *a*, *Babes — Corn.* et *Bab.*, Bactér., p. 153, fig. 91).
53. **B. tremaergasius** Trev. (Bacille du mucus intestinal normal *d*, *Babes — Corn.* et *Bab.*, Bactér., p. 153, fig. 94).
54. **B. Babesi** Trev. (Bacille du mucus intestinal normal *b*, *Babes — Corn.* et *Bab.*, Bactér., p. 153, fig. 92).
55. **B. oonergasius** Trev. (Bacille du mucus intestinal normal *c*, *Babes — Corn.* et *Bab.*, Bactér., p. 153, fig. 93).

β — *Della cavia.*

56. **B. caviae** Trev. (Bacille du mucus intestinal normal du cobaye *e*, *Babes — Corn.* et *Bab.*, Bactér., p. 154, fig. 95). — Apparterrebbe forse al genere *Pasteurella?*

D — *Nelle feci normali dell'uomo. (Non liquefano la gelatina).*

57. **B. mesenthericus** Trev. (Bacillus aus Faeces N. 1 *Bienstock*).
58. **B. coprocinus** Trev. (Bacillus aus Faeces N. 2 *Bienstock*).
59. **B. enteromyces** Trev. (Bacille des selles *f*, *Babes — Corn.* et *Bab.*, Bactér., p. 154, fig. 96).
60. **B. Utpadeli** Trev. (Bacillus aus Zwischendeckenfüllung *Utpadel*).
61. **B. neapolitanus** C. Fränkel (Neapeler Bacillus *Emmerich*, 1884).
62. **B. cavicida** Flügge (Mikroorgan., p. 268).
63. **B. parvus** Trev. (Bacillus aus Faeces N. 3 *Bienstock*; Bacillus coprogenus parvus *Flügge*).

E — *Nelle feci normali dei bambini a partire dal momento in cui furono spoppati. (Decompone l'albumina sterilizzata).*

64. **B. diaphthirus** Trev. (Bacillus aus Faeces N. 5 *Bienstock*).

F — *Nelle feci normali dei bambini lattanti.*

(Non liquefano la gelatina).

65. **B. lactantium** Trev. (Bacterium lactis aërogenes *Escherich*, 1885; Bacterium aceticum *Baginsky*, 1888).
66. **B. Escherichii** Trev. (Bacterium coli commune *Escherich*).

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16

§ 4. Bacilli piogeni.

* Incolori.

67. **B. foetidus** Trev. (Bacillus pyogenes foetidus *Passet*, 1885).
68. **B. inodorus** Trev. — Somigliantissimo al precedente, ma sempre affatto privo del forte fetido odore di putrefazione che è proprio di quest'ultimo, nè patogeno pei topi e per le cavie che il *foetidus* fa morire in 24 ore.

** Pigmentari.

69. **B. osteomyeliticus** Trev., 1884 (Bacille de l'ostéomyélite *Rodet*).
70. **B. aeruginosus** Trev., 1885 (Bacterium aeruginosum *Schröt.* 1872; Bacillus pyocyaneus *Flügge*).
71. **B. Hajeki** Trev. (Bacillus foetidus Ozenae *Hajek*, 1887).

§ 5. Bacilli zimogeni.

* In fermentazioni ureiche normali.

72. **B. ureae** Flügge (Bacterium ureae *Leube*).
73. **B. dissimilis** Trev. (Erste Bacillus in Harn von Leube *Flügge*).
74. **B. secundus** Trev. (Zweite Bacillus in Harn von Leube *Flügge*).

** In fermentazioni lattiche.

75. **B. acidi-lactici** Zopf (Milchsäurebacillus *Hüppe*).
76. **B. tenuis** Trev. (Tyrothrix tenuis *Duclaux*).
77. **B. filiformis** Trev. (Tyrothrix filiformis *Duclaux*).
78. **B. distortus** Trev. (Tyrothrix distortus *Duclaux*).
79. **B. geniculatus** Trev. (Tyrothrix geniculatus *Duclaux*).
80. **B. turgidus** Trev. (Tyrothrix turgidus *Duclaux*).
81. **B. scaber** Trev. (Tyrothrix scaber *Duclaux*).

*** In fermentazioni acetiche.

82. **B. aceti** Trev. (Mycoderma aceti *Pasteur*, 1868; Bacterium aceti *Lanzi*, 1876).
83. **B. Pasteurianus** Flügge (Bacterium Pasteurianum *E. Hansen*).
84. **B. oblongus** Trev. (Micrococcus oblongus *Boutroux*, 1880).
85. **B. Boutrouxii** Trev. (« Nouveau Micrococcus capable d'acétifier l'alcool beaucoup plus lentement que le Micrococcus oblongus dans les mêmes conditions » *Boutroux*, Annal. Pasteur, 1888).
86. **B. xylinus** Trev. (Bacterium xylinum *A. J. Brown*, 1887).

**** In fermentazioni varie.

(Della fermentazione del pane).

87. **B. dysodes** Zopf (Spaltpilze, 3. ed., p. 90).
88. **B. panificans** Laurent (1887).

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89. **B. zymoseus** Trev. (Coccobacillus zymogenes *Leube*, 1885).
90. **B. Fitzianus** Zopf (Spaltpilz., p. 84, fig. 28).

§ 6. Bacilli saprofiti.

* Bacilli eterogenei.

A — Incolori.

A — *Liquefano la gelatina.*

91. **B. subtilis** F. Cohn (Bacillo del fieno).

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92. **B. carotarum** Alfr. Koch (Botanische Zeitung, 1888, p. 279).
93. **B. tumescens** Zopf (Zopfiella tumescens *Trev.*, 1885) (*).
94. **B. Megaterium** De Bary (1884).
95. **B. brassicae** Pommer (1886).
96. **B. fusisporus** Schröter (Kryptog. Flor. von Schlesien, 1886).

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97. **B. Weckeri** Trev. (Bacillus der Jequirity - Ophthalmie *Flügge*).

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98. **B. Proteus** Trev. (Proteus vulgaris *Hauser*).
99. **B. Lindenborni** Trev. (Proteus sulfureus *Holschewnikoff*, Annales de Micrographie, II^{ème} Année, N. 6 du 15 Mars 1889, p. 257).
100. **B. protervus** Trev. (Bacillus der Conjunctivalsack *d, Fick*, 1887).
101. **B. mirabilis** Trev. (Proteus mirabilis *Hauser*).
102. **B. Zenkeri** Trev. (Proteus Zenkeri *Hauser*).

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103. **B. Strassmanni** Trev. (Bacillus albus cadaveris *Strassmann* und *Strecker*, Bakterien bei der Leichenfäulniss, 1888).
104. **B. Streckeri** Trev. (Bacillus citreus cadaveris *Strassmann* und *Strecker*, l cit.).

B — *Non liquefano la gelatina.*

105. **B. albus** Pagliani, Maggiora e Fratini, 1887 (Weisser Bacillus *Eisenberg*).
106. **B. Schottelii** Trev. (Bacillus coprogenes foetidus *Flügge*).
107. **B. oxytocus** Trev. (Bacillus oxytocus perniciosus *Flügge*).

C — *Nessun sviluppo nella gelatina.*

108. **B. saprogenes** (N. 1) Rosenbach (1884).
109. **B. Ulna** F. Cohn (1872).

D — *Sviluppo nella gelatina ignoto.*

110. **B. Malariae** Klebs (1879).
111. **B. maydis** Trev. (Bacterium maydis *Maiocchi*, 1881).
112. **B. gummis** Trev. (Bacterium gummis *Gomes*).

B — Pigmentarî.

113. **B. indicus** Trev. (Micrococcus indicus *R. Koch*).
114. **B. imetrophus** Trev., 1887 (Zoogalactina imetropha *Sette*, 1824; Monas prodigiosa *Ehrenberg*, 1848).
115. **B. erythrosporus** F. Cohn (1873).
116. **B. ruber** Frank (*Cohn*, Beitr. I, 3, p. 181, 1875).
117. **B. sulfureus** Trev. (Bacterium sulfureum *Holschewnikoff*, Annales de Micrographie, II^{ème} Année, N. 6 du 15 mars 1889, p. 261).
118. **B. luteo-albus** Beyerinck (Botanische Zeitung, 1889, p. 749).
119. **B. Balbianii** Trev. (Bacterium Balbianii *Billet*, 1888).
120. **B. synxanthus** Flügge (Vibrio synxanthus *Ehrenberg*, 1840).

(*) La distinzione di un genere essenzialmente caratterizzato dalla provenienza di spore tanto in baculi, quanto in cocchi, poggia sull'errore, giacchè i pretesi cocchi sporiferi di Zopf non sono cocchi, ma bensì normali microbaculi.

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18

121. **B. cyanogenus** Zopf (Vibrio cyanogenus *Ehrenberg*, 1841).
122. **B. fluorescens** Trev. (Bacillus fluorescens liquefaciens *Flügge*).
123. **B. putidus** Trev. (Bacillus fluorescens putidus *Flügge*).
124. **B. brunneus** Trev. (Bacterium brunneum *F. Cohn*).
125. **B. agglomerans** Beyerinck (Botanische Zeitung, 1888, p. 749).

** Bacilli fosforescenti.

126. **B. Hermesi** Trev. (Bacterium phosphorescens *Hermes*, 1887). Immobile. Non liquefa la gelatina.
127. **B. Fischeri** Trev. (Einheimischen Leuchtbacillus « aus Ostsee » *B. Fischer*, 1888). Mobile. Liquefa la gelatina.

*** Bacilli epigrobi.

A — *Incolori.*

128. **B. synchyseus** Trev. (Bacterium merismopedioides *Zopf*, Spaltpilze, p. 65, fig. 19, escluse le figure *F, G, H, I*).
129. **B. tortuosus** Trev. (Bacterium tortuosum *Zukal*, 1885).
130. **B. insidiosus** Trev., luglio 1885 (Bacillus murisepticus *Flügge*, agosto 1886).

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131. **B. tremulans** Trev. (Vibrio tremulans *Ehrenb.*, 1838; Bacterium tremulans *Trev.*, 1879, non *F. Cohn*).
132. **B. Lineola** Trev. (Vibrio Lineola *O. F. Müller*, 1773; Bacterium Lineola *Trev.*, 1879).
133. **B. Catenula** Trev. (Bacterium Catenula *Dujardin*, 1841).
134. **B. Termo** Trev. (Bacterium Termo *Ehrenberg*, 1830).
135. **B. microtis** Trev. (Bacterium microsporum *Trev.*, Il mal nero e la filossera a Valmadrera, 1879).
136. **B. Punctum** Trev. (Bacterium Punctum *Ehrenb.*, 1830; Bacterium tremulans *F. Cohn*, Oss. 1, 1872).
137. **B. Enchelys** Trev. (Bacterium Enchelys *Ehrenberg*, 1830).
138. **B. griseus** Trev. (Bacterium griseum *Warming*, 1875).
139. **B. litoreus** Trev. (Bacterium litoreum *Warming*, 1875).
140. **B. [illegible]bergii** Trev. (Bacterium triloculare *Ehrenb., Jakubowicz*).

B — *Pigmentari.*

141. **B. janthinus** Flügge (Mikroorgan., p. 291).

(*Chromatium* Perty, Winogradsky).

142. **B. Okenii** Trev. (Monas Okenii *Ehr.*; Bacterium Okenii *Trev.*, 1879).
143. **B. Weissii** Trev. (Chromatium Weissii *Perty*, 1852).
144. **B. minor** Trev. (Chromatium minus *Winogradsky*, 1888).
145. **B. vinosus** Trev. (Monas vinosa *F. Cohn*).
146. **B. minutissimus** Trev. (Chromatium minutissimum *Winogradsky*).

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147. **B. photometricus** Trev. (Bacterium photometricum *Engelm.*, 1882).

Pigmentari, verdi o verdognoli; noti poco più che di nome.

148. **B. Engelmanni** Trev. (Bacterium chlorinum *Engelmann*). Mobile.
149. **B. virens** Van Tieghem. Immobile.
150. **B. viridis** Trev. (Bacterium viride *Van Tieghem*). Immobile.

§ 7. Bacilli endofitobii destruenti. (*)

151. **B. Vuillemini** Trev. (Bacillus des tumeurs du Pin d'Alep *Vuillemin*, Compt. rend. Ac. sc. Par., Tom. CVII, 1888).
152. **B. Prillieuxianus** Trev. (Bacillus des tumeurs de l'Olivier *Prillieux*, Compt. rend. Ac. sc. Par., Tom. CVIII, 1889, p. 249).
153. **B. amylovorus** Trev. (Micrococcus amylovorus *Burrill*, 1882).
154. **B. hyacinthi** Trev. (Bacterium della malattia gialla dei giacinti *Wakker*).
155. **B. radicicola** Beyerinck (Botanische Zeitung, 1888, p. 726).

§ 7. Bacilli di cui non si conoscono le proprietà specifiche, ottenuti sopra substrati di cultura.

* Compursi casualmente sopra patate cotte per culture.

156. **B. mesentericus** Trev. (Bacillus mesentericus fuscus *Flügge*).
157. **B. vulgatus** Trev. (Bacillus mesentericus vulgatus *Flügge*).
158. **B. liodermos** Flügge (Mikroorgan., p. 323).
159. **B. multipediculus** Flügge (l. cit., p. 329).
160. **B. roseus** Trev. (*Globig*, Zeitschr. f. Hygiene, Bd. III, 1887, p. 322).

** Ottenuti da culture dei terreni.

161. **B. mycoides** Flügge (Mikroorgan., p. 324).
162. **B. Paglianii** Trev. (Bacillus fluorescens *Pagliani*, *Maggiora* e *Fratini*, 1887, non Bacillus fluorescens (liquefaciens) *Flügge*, 1886).
163. **B. viridi-luteus** Pagliani, Maggiora e Fratini, 1887 (Grüngelber nicht verflüssiger Bacillus *Eisenberg*).

*** Ottenuti da culture delle acque.

164. **B. aquatilis** Trev. (Bacille de l'eau *a*, *Babes — Corn.* et *Bab.*, Bactér., p. 167).
165. **B. geton** Trev. (Bacille de l'eau *b*, *Babes — Corn.* et *Bab.*, Bactér., p. 168, fig. 168).
166. **B. hydrocharis** Trev. (Bacille de l'eau *c*, *Babes — Corn.* et *Bab.*, Bactér., p. 168).
167. **B. stolonatus** Adametz und Wichmann, (1888).
168. **B. Adametzi** (Brauner pigmentbildender Wasserbacillus *Adametz* und *Wichmann*, 1888).
169. **B. erythraeus** Trev. (Ziegelrother Wasserbacillus *Adametz* un *Wichmann*, 1888).
170. **B. aurantius** Trev. (Orangerother Wasserbacillus *Adametz* und *Wichmann*, 1888).
171. **B. Wichmanni** Trev. (Goldgelber Wasserbacillus *Adametz* und *Wichmann*, 1888).
172. **B. flavocoriaceus** Adametz und Wichmann, 1888).

(*) Appartengono ad una categoria di batteri che vivono nei tessuti sani di piante viventi e la cui azione non è un'azione putrefattiva, ma un'azione speciale. Danno origine a dei batteriocecidi, o corrodono i tessuti e vi scavano delle cavità.

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20

173. **B. coeruleo-viridis** Trev. (Blaugrün fluorescirendes Bacterium *Adametz*).
174. **B. coeruleus** All. J. Smith (1887).

**** Bacilli ottenuti da culture dell'aria.

A — *Liquefano la gelatina.*

175. **B. pestifer** G. C. and P. F. Frankland (1888).
176. **B. cladogenes** Trev. (Bactérie de l'air N. 3. *Babes — Corn.* et *Bab.*, Bactér., p. 140, fig. 65).
177. **B. Praussnitzi** Trev. (Bacillus ramosus liquefaciens *Flügge*).
178. **B. aeschynomenus** Trev. (Bacille de l'air *j*, *Babes — Corn.* et *Bab.*, Bacter., p. 150, fig. 89).
179. **B. simulans** Trev. (Bacille de l'air *a*, *Babes — Corn.* et *Bab.*, Bactér., p. 149, fig. 81).
180. **B. cereus** G. C. and P. F. Frankland (1888).
181. **B. laevis** G. C. and P. F. Frankland (1888).
182. **B. grandis** Trev. (Bacille de l'air *h*, *Babes — Corn.* et *Bab.*, Bactér., p. 150, fig. 88).
183. **B. viator** Trev. (Bacille de l'air *e*, *Babes — Corn.* et *Bab.*, Bactér., p. 150, fig. 85).
184. **B. cathetus** Trev. (Bacille de l'air *g*, *Babes — Corn.* et *Bab.*, Bactér., p. 150, fig. 87).
185. **B. chlorinus** G. C. and P. F. Frankland (1888).
186. **B. aerophilus** Flügge (Mikroorgan., p. 321).
187. **B. aureus** G. C. and P. F. Frankland (1888).

B — *Non liquefano la gelatina.*

188. **B. amerimnus** Trev. (Bacille de l'air *b*, *Babes — Corn.* et *Bab.*, Bactér., p. 149, fig. 82).
189. **B. profusus** G. C. and P. F. Frankland. (1888).
190. **B. plicatus** G. C. and P. F. Frankland (1888).
191. **B. encephaloides** Trev. (Bacille de l'air *f*, *Babes — Corn.* et *Bab.*, Bactér., p. 150, fig. 86).
192. **B. paullulus** Trev. (Bacille de l'air *d*, *Babes — Corn.* et *Bab.*, Bactér., p. 149, fig. 84).
193. **B. anthracoides** Trev. (Bacille de l'air *k*, *Babes — Corn.* et *Bab.*, Bactér., p. 151, fig. 90).
194. **B. aëthebius** Trev. (Bacille de l'air *c*, *Babes — Corn.* et *Bab.*, Bactér., p. 149, fig. 83).
195. **B. radians** Trev. (Bactérie de l'air N. 2 *Babes — Corn.* et *Bab.*, Bactér. p. 140, fig. 63).
196. **B. assimilis** Trev. (Bacille de l'air *i*, *Babes — Corn.* et *Bab.*, Bactér., p. 150, tav. IV, fig. 13).
197. **B. polymorphus** G. C. and P. F. Frankland (1888).
198. **B. humilis** Trev. (Bactérie de l'air N. 1 *Babes — Corn.* et *Bab.*, Bactér., p. 140, fig. 62).
199. **B. citreus** G. C. and P. F. Frankland (1888).
200. **B. aurescens** G. C. and P. F. Frankland (1888).
201. **B. luteus** Flügge (Mikroorgan., p. 290).

Gen. XV. PASTEURELLA Trev. (Sul Micrococco della rabbia, p. 7, gennaio 1887) — Coccobacillus *Gamaleïa* (febbraio 1888), non *Leube*.

Baculi con protoplasma polare-diblastico. Spore microsome provenienti in baculi normali immutati.

A — *Zoobie.*

1. **P. bubali** Trev. (Microbo del barbone dei bufali *Oreste* ed *Armanni*, 1887).
2. **P. Bollingeri** Trev. (« Mikroparasiten bei eine neue Wild- und Rinderseuche » *Bollinger*, 1878). — Pasteurella della peste dei cervi e dei cignali).
3. **P. Salmoni** Trev. (Bacillus of the Swinefever *Salmon*. 1886). — Pasteurella della pneumoenterite infettiva dei porci, « Swine-fever » degli Americani. Sempre mobile.
4. **P. suilla** Trev., Sul Micrococco della rabbia, p. 7, 1887 (Bacillus parvus ovatus *Flügge*). — Pasteurella della pnemonia infettiva, « Schweineseuche » di Löffler e Schütz. Immobile.
5. **P. avicida** Trev. (Pasteurella cholerae - gallinarum *Trev.*, 1887 : Coccobacillus avicidus *Gamaleïa*).
6. **P. nissicida** Trev. (Bactérie du choléra des canards *Cornil* et *Toupet*, 1888).

B — *Antropobie.*

7. **P. Kreibohmi** Trev. (Backterien menschlicher Mundsecrete erste Art *Flügge*, Mikroorgan., p. 257).
8. **P. Weichselbaumi** Trev. (Diplobacillus brevis endocarditis *Weichselbaum*. 1887).
9. **P. Hlavai** Trev. (Bacillus « purpurae variolosae » *Hlava*, 1887).

C — *Saprofite.*

10. **P. cuniculicida** Trev. (Bacillus cuniculicida *Flügge*).
11. **P. phosphorescens** Trev. (Bacillus phosphorescens « aus Westindien » *B. Fischer*. 1887).

D — *Geofita*

12. **P. agrigena** Trev. (Bacillus septicus agrigenus *Flügge*).

Gen. XVI. CORNILIA Trev.

Baculi con protoplasma uniformemente diffuso. Spore macrosome (*) provenienti nelle parti mediane intumescenti, di regola non mai nelle estremità, di baculi normali immutati.

1. **Eucornilia.**

A — Liquefano la gelatina.

1. **C. alvei** Trev. (Bacillus alvei *Flügge*). Cornilia della putrefazione delle larve degli alveari delle api.

(*) Cioè che, raggiungendo un diametro costantemente maggiore del diametro trasversale normale dei baculi entro cui si formano, costringono questi a tumefarsi nei punti sporiferi.

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22

2. **C. radiata** Trev. (Bacillus radiatus *Lüderitz*, 1888).
3. **C. spinosa** Trev. (Bacillus spinosus *Lüderitz*, 1888).
4. **C. magna** Trev. (Bacillus liquefaciens magnus *Lüderitz*, 1888).
5. **C. parva** Trev. (Bacillus liquefaciens parvus *Lüderitz*, 1888).
6. **C. foetida** Trev. (Clostridium foetidum *Liborius*, 1886).
7. **C. solida** Trev. (Bacillus solidus *Lüderitz*, 1888).

B — Non liquefano la gelatina.

8. **C. polypiformis** Trev. (Bacillus polypiformis *Liborius*, 1886).
9. **C. muscoides** Trev. (Bacillus muscoides *Liborius*, 1886).

C — Nessun sviluppo sulla gelatina a circa 22°.

10. **C. Pasteuri** Trev. (Vibrion septique *Pasteur*, 1887; Vibrio Pasteuri *Trev.*, Batter. ital., p. 26, 1879; Bacillus oedematis maligni *Zopf.* 1886).
11. **C. catenula** Trev. (Tyrothrix catenula *Duclaux*, Le Lait, p. 249, fig. 9, N. 1, 1887).
12. **C. Hansenii** Trev. (Bacillus Hansenii *Rasmussen*).

§ 2. **Pleurospora.** — Spore macrosome spingentisi in fuori da un lato del baculo prima di renderlo intumescente in corrispondenza al luogo in cui si sono formate.

13. **C. tremula** Trev. (Bacillus tremulus *R. Koch*, 1877).
14. **C. Sphinx** Trev. (Bacillus Sphinx *Trev.*, 1885).

Gen. XVII. CLOSTRIDIUM Prazmowski (1880) — Amylobacter *Trécul.* (1865).

Baculi con protoplasma uniformemente diffuso. Spore microsome provenienti in baculi speciali intumescenti ellissoideo-fusiformi.

1. **Cl. Polymyxa** Prazmowski (1880).
2. **Cl. butyricum** Prazmowski (Bacillus Amylobacter *Van Tieghem*, 1877).
3. **Cl. Liborii** Trev. (Liborius' Buttersäurebildender Bacillus *Flügge*).
4. **Cl. Hüppei** Trev. (Bacillus butyricus *Hüppe*).
5. **Cl. inflatum** Trev. (Bacillus inflatus *Alfr. Koch*, Botanische Zeitung, 1888, p. 328).
6. **Cl. Ventriculus** Trev. (Bacillus Ventriculus *Alfr. Koch* (Botanische Zeitung, 1888, p. 341).

Zoobii.

7. **Cl. Feseri** Trev., Atti dell'Accad. Fis.-med.-stat. di Milano, Ser. IV, Vol. III, p. 116, 1885 (Bacillus des Rauschbrands *Flügge;* Bacillus Chauvaei *Arloing, Cornevin* et *Thomas*, 1887).
8. **Cl. Eberthi** Trev. (Bacillus bei Nekrose der Leber *Eberth*).

Gen. XVIII. VIBRIO Zopf (Spaltpilze, 3.ª ediz., p. 91, fig. 31 — 1885).

Baculi cilindrici non mai spirali, con protoplasma uniformemente diffuso. Spore macrosome provenienti in una estremità di baculi speciali claviformi intumescente a guisa di capocchia.

1. **V. Rugula** O. F. Müller (1786).

2. **V. amphibolus** Trev. (*Babes*, Zeitschr. für Hygiene, V Bd., 1888, p. 183, tav. II, fig. 34). Anaerobio obbligato. Liquefa la gelatina.
3. **V. typhosus** Trev. (Bacillus typhosus *Eberth*, 1880). Anaerobio facoltativo. Non liquefa la gelatina.

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4. **V. luminosus** Beyerinck (Botanische Zeitung, 1888, p. 763).

Gen. XIX. PACINIA Trev. (Il fungo del choléra asiatico, p. 8, 1885) — Dispora *Kern*.

Baculi cilindrici, non mai spirali, con protoplasma uniformemente diffuso. Spore macrosome (*) provenienti in una estremità intumescente a guisa di capocchia, di rado in entrambe le estremità, di baculi normali immutati.

§ 1. **Eupacinia.** — Filamenti normali di Bacillus.

A — *Non liquefa la gelatina.*

1. **P. putrifica** Trev (Bacillus aus Faeces N. 4 *Bienstock;* Bacillus putrificus coli *Flügge*).

B — *Liquefa la gelatina.*

2. **P. Micheli** Trev. (Luftstäbchen des Conjunctivalsecretes *Michel*, 1882; Xerosebacillus *Schleich* und *Schulz*, 1887, non *Neisser*; Bacillus *a* des Conjunctivalsackes *E. Fick*, 1887). Mobile.

C — *Nessun sviluppo nella gelatina.*

3. **P. Ferrarii** Trev. (Bacillo dell'ulcera molle *Ferrari*, 1885; Bacillus bei Ulcus molle *Neisser*, 1888). Mobile.
4. **P. Neisseri** Trev. (Xerosebacillus *Neisser*, 1883-1888; Bacillus *b* des Conjunctivalsackes *E. Fick*, 1887). Immobile.
5. **P. Fickii** Trev. (Bacillus *c* des Conjunctivalsackes *E. Fick*, 1887).
6. **P. Nicolaieri** Trev. (Tetanusbacillus *Nicolaier*, 1884).
7. **P. Löffleri** Trev. (Bacillus bei Diphtherie des Menschen *Löffler*).
8. **P. syphilitica** Trev. (Syphilisbacillus *Lustgarten*).
9. **P. caucasica** Trev. (Dispora caucasica *Kern*).

§ 2. **Pseudospira.** — Filamenti ondulato-flessuosi o irregolarmente pseudospirali, non mai normalmente presentanti la forma a guisa di cavaturaccioli dei tipici *Spirillum*.

A — *Non liquefa la gelatina.*

10. **P. rabida** Trev. (Spirillum bei Rabies *Babes*, Zeitschrift für Hyg., V. Bd., 1888, p. 181, 189, tav. II, fig. 11, 22, 23, 27, 28, 29, 29').

B — *Liquefano la gelatina.*

11. **P. cholerae-asiaticae** Trev., Il fungo del choléra-asiatico, p. 9. (Vibrio cholerae *Pacini*, 1854; Cholerabacillus *R. Koch*, 7 settembre 1883; Kommabacillus *R. Koch*, 2 febbraio 1884).
12. **P. Metschnikoffi** Trev. (Vibrio Metschnikoffi *Gamaleïa*, 1888).
13. **P. Denekei** Trev. (« Den Choleraspirillen ähnliche Spaltpilzart » *Deneke*, 1885; Spirillum tyrogenum *Flügge*, 1886).

(*) Osservate in tutte, nessuna eccettuata, le specie riferitevi.

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24

14. **P. Finkleri** Trev., Il fungo del choléra-asiatico, p. 9, 1885 (Bacillus der Cholera nostras *Finkler* und *Prior*, 1884).

C — *Nessun sviluppo nella gelatina.*

15. **P. Lewisi** Trev., Il fungo del choléra-asiatico, p. 10, 1885 (Spirillum sputigenum *Flügge*, 1886; Vibrio buccalis *W. Miller*, 1887).
16. **P. decipiens** Trev. (Spirillum aus der Luft *Babes*, Zeitschr. für Hygiene, V Bd., 1888, p. 183, 190, tav. II, fig. 39).

Gen. XX. SPIRILLUM Ehrenberg (1830) — Spirochaete *Ehrenb.* (1833); Ophidomonas *Ehrenb.* (1836); Thiospirillum *Winogradsky* (1888).

Baculi cilindrici, torti a spira. Spore microsome provenienti in baculi normali immutati.

§ 1. **Euspirillum.** — Spirilli tipici, costantemente con forme a guisa di cavaturaccioli.

* Euspirilli incolori.

A — *Saprofiti.*

1. **Sp. plicatile** Dujardin, 1841 (Spirochaete plicatilis *Ehrenb.*, 1883).
2. **Sp. giganteum** Trev. (Spirochaete gigantea *Warming*, 1875).
3. **Sp. Kochii** Trev. (Spirochaete Kochii *Trev.*, Batt. ital., p. 26, 1879).
4. **Sp. volutans** Ehrenb., 1830 (Vibrio-Spirillum *O. F. Müller*, 1786).
5. **Sp. Undula** Ehrenb., 1830 (Vibrio Undula *O. F. Müller*, 1773).
6. **Sp. tenue** Ehrenb. (1838).
7. **Sp. attenuatum** Warming (1875).
8. **Sp. serpens** Flügge, 1886 (Vibrio serpens *O. F. Müller*, 1786).
9. **Sp. concentricum** Kitasato (1888).
10. **Sp. endoparagogicum** Sorokin (1887).

B — *Zimogeno.*

11. **Sp. amyliferum** Van Tieghem (Bullet. Soc. botan. Franc., 1879).

C — *Antropobii.*

12. **Sp. Obermeieri** Flügge (Spirochaete Obermeieri *E. Cohn*, 1875).
13. **Sp. nasicola** Trev. (Nasenschleim-Vibrio *E. Weibel*, 1887).
14. **Sp. Cohnii** Trev. (Spirochaete Cohnii *Trev.*, Batter. ital., p. 25, 1879; Spirochaete denticola *Flügge*, 1886).

** Euspirilli pigmentari.

15. **Sp. flavescens** Trev. (Vibrio flavescens *E. Weibel*, 1887).
16. **Sp. flavum** Trev. (Vibrio flavum *E. Weibel*, 1887).
17. **Sp. aureum** Trev. (Vibrio aureum *E. Weibel*, 1887).

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18. **Sp. rufum** Perty (Kleinst. Lebensform., p. 179, tav. XV, fig. 29, 1852).
19. **Sp. jenense** Trev., Batter. ital., p. 26, 1879 (Ophidomonas jenensis *Ehrenberg*, 1838).

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20. **Sp. sanguineum** F. Cohn (Ophidomonas sanguinea *Ehrenberg*).
21. **Sp. violaceum** Warming (1875).
22. **Sp. rubrum** Esmarch (1887).
23. **Sp. rosaceum** Klein (1875).

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24. **Sp. leucomelaenum** Perty (l. cit., fig. 31).
25. **Sp. Rosenbergii** Warming (1875).

§ 2. **Pseudospirillum.** — Spirilli anomali, contorti, ondulati o irregolarmente pseudospirali, non mai normalmente presentanti la tipica forma a guisa di cavaturaccioli.

Analoghi alle Pacinie del § 2 *(Pseudospira)*. Spore ignote.

26. **Sp. amphibolum** Trev. (Vibrio aus dem zungenbelag *E. Weibel*).
27. **Sp. saprophilum** Trev. (Heu-Vibrio α, *E. Weibel*, 1887).
28. **Sp. Weibelii** Trev. (Vibrio saprophiles γ, *E. Weibel*, 1888).
29. **Sp. anceps** Trev. (Heu-Vibrio β, *E. Weibel*, 1887).
30. **Sp. propellor** Mühlhaüser (1884).
31. **Sp. pisciculus** Mühlhäuser (1884).
32. **Sp. musculus** Mühlhäuser (1884).

Gen. XXI. SPIROMONAS Warming (1875).

Baculi compressi, torti intorno ad un asse ideale longitudinale.

1. **Sp. Cohnii** Warming (1875).
2. **Sp. volubilis** Flügge (Mikroorgan., p. 400).

Trib. IV. **KLEBSIELLEE** Trev. (1887). — Baculi, filamenti e cocchi racchiusi in capsule membranaceo-gelatinose.

Gen. XXII. KLEBSIELLA Trev. (Caratteri di alcuni nuovi generi di Batteriacee, p. 15, 1885) — Ascobacillus *Edington* (1887).

Baculi con protoplasma uniformemente diffuso. Spore microsome.

§ 1. Baculi cilindrici.

A — *Antropobie.*

1. **Kl. Bordonii** Trev. (*) (Proteus hominis capsulatus *Bordoni-Uffreduzzi*, 1887).
2. **Kl. Proteus** Trev. (*) (Proteus capsulatus septicus *Banti*, 1888).
3. **Kl. septica** Trev. (*) (Bacillus capsulatus septicus *Banti*, 1888).
4. **Kl. putrifica** Trev. (*) (Bacillus capsulatus putrificus *Banti*, 1888).
5. **Kl. Bantii** Trev. (*) (Bacillus capsulatus pneumonicus *Banti*, 1888).
6. **Kl. crassa** Trev. (*) (Bacillus crassus sputigenus *Kreibohm*, 1886).
7. **Kl. rhinoscleromatis** Trev., Sul Micrococco della rabbia, p. 8 (1887). Klebsiella del rinoscleroma.
8. **Kl. Belfantii** Trev. (« Bacterium in materiale tetanigero » *Belfanti* e *Pescarolo*, 1888).
9. **Kl. Edingtonii** Trev. (*) (Ascobacillus of scarlet fever *Edington*, 1887).

B — *Zimogena.*

10. **Kl. indigogena** Trev. (*) (Bacillus indigogenus *Alvarez*, 1887).

(*) TREVISAN, *Sui Batteri spettanti al genere Klebsiella.* (Nei Rendiconti del R. Istituto Lombardo di scienze e lettere, Ser. II, Vol. XXI, fascic. XX, adunanza del 20 decembre 1888).

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26

C — *Geofita.*

11. **Kl. anceps** Trev. (Pseudo-Oedembacillus *Liborius*, 1886).

§ 2. **Baculi ellissoideo-fusiformi.**

12. **Kl. Friedländeri** Trev. (*) (Pneumokokkus *Friedländer*, 1882; Bacillus pneumoniae *Flügge*, 1886).
13. **Kl. equi** Trev. (Bacterium pneumoniae crouposae equi *Perroncito*, 1886).
14. **Kl. aerobia** Trev., Sul Micrococco della rabbia, p. 8 (Bactérie capsulaire de l'air *Babes — Corn.* et *Bab.*, Bactér., p. 144).
15. **Kl. capriformis** Trev. (*) (Micrococcus capriformis *Edington*, 1887).
16. **Kl. salivaris** Trev., Sul Micrococco della rabbia, p. 8 (Diplococcus pneumoniae *Weichselbaum*, 1887; Streptococcus lanceolatus Pasteuri *Gamaleïa*, 1888).
17. **Kl. Babesi** Trev. (*) (Microbe des selles *Babes — Corn.* et *Bab.*, Bactér., p. 146).
18. **Kl. Leydeni** Trev. (*) (Pseudo-diplococcus pneumonicus *Bonome*).

Gen. XXIII. DICOCCIA Trev.

Baculi con protoplasma polare-diblastico. Spore ignote.

Da *Klebsiella* differisce affatto come tra le Bacillee *Pasteurella* da *Bacillus*.

1. **Dic. glossophila.** Trev. (Backterien menschlicher Mundsecrete zweite Art *Flügge*, Mikroorgan., p. 258).

Gen. XXIV. MYCONOSTOC F. Cohn (1875).

1. **M. gregarium** F. Cohn (Beitr. I, 3, p. 183, tav. 5, fig. 6).

Sottordine III. **COCCOGENE** Trev. (1885) — Un unico stato di sviluppo vegetativo: Cocchi.

Trib. V. **ASCOCOCCEE** Trev. (1885) — Cocchi aggregati in famiglie racchiuse in cisti membranaceo-gelatinose.

Gen. XXV. ASCOCOCCUS F. Cohn (1875).

1. **A. Billrothii** F. Cohn (Beitr. I, 3, p. 151, tav. 5, fig. 2-5).

Gen. XXVI. BOLLINGERA Trev. — Discomyces *Rivolta* (1884); Botryomyces *Bollinger* (1886); Botryococcus *Kitt* (1888), non *Kützing* Spec. Alg. p. 892 (1849).

1. **B. equi** Trev. (Zoogloea pulmonis equi *Bollinger*, 1870; Discomyces equi *Rivolta*, 1884; Micrococcus ascoformans *Johne*, 1885; Micrococcus botryogenus *Rabe*, 1886).

(*) TREVISAN, Op. cit.

Gen. XXVII. LAMPROCYSTIS Schröter (Kryptog. Flor. von Schles., 1886) — Cohnia *Winter*, non *Cohnia* Kunth, 1850 (Dracenacee), nè *Cohnia* Reichenb. f., 1852 (Orchidee).

1. **L. roseo-persicina** Schröter (Chlathrocystis roseo-persicina *F. Cohn*, Beitr. I, 3, p. 157, tav. VI, fig. 1-3, 6-10).

Gen. XXVIII. AMOEBOBACTER Winogradsky (1888).

1. **A. roseus** Winogradsky (Beitr., p. 77, tav. 3, fig. 1-6).
2. **A. bacillosus** Winogradsky (l. cit., p. 78, tav. 3, fig. 7).
3. **A. granula** Winogradsky (l. cit., p. 78, tav. 3, fig. 8).

Gen. XXIX. CHLAMYDATOMUS Trev., Batteri italiani, p. 13, 1879).

1. **Chl. Beigelii** Trev., l. cit., p. 22 (Sclerotium Beigelianum *Hallier*, 1868; Pleurococcus Beigelii *Küchenm* et *Rabenh.*, 1868; Zoogloea Beigeliana *Eberth*, 1873).

Gen. XXX. THIOCYSTIS Winogradsky (1888).

1. **Th. violacea** Winogradsky (Beitr., p. 65, tav. II, fig. 1-7).
2. **Th. rufa** Winogradsky (Beitr., p. 65, tav. II, fig. 8).

Gen. XXXI. THIOTHECE Winogradsky (1888).

1. **Th. gelatinosa** Winogradsky (Beitr., p. 82; tav. III, fig. 9-12).

Gen. XXXII. GAFFKYA Trev. (Caratteri di alcuni nuovi generi di Batteriacee, p. 16, 1885).

1. **G. tetragena** Trev., 1885 (Micrococcus tetragenus *Gaffky*).
2. **G. Archeri** Trev. (« A black Micrococcus » *Archer*, 1874).

Trib. VI. **SARCINEE** Trev. (1879). — Cocchi più o meno densamente aggregati senz'ordine, o ad 8 ad 8, o a 4 a 4, in famiglie pluristrate od unistrate, più o meno avvolte in ganga gelatinosa, non mai racchiuse in cisti speciali.

Gen. XXXIII. THIOPOLYCOCCUS Winogradsky (1888).

Cocchi densissimamente aggregati in famiglie solide cumuliformi, senza forma definita. Ganga gelatinosa tenuissima, appena conspicua. Temnogenesi in un'unica direzione.

1. **Th. ruber** Winogradsky (Beitr., p. 70, tav. 4, fig. 16-19).

Gen. XXXIV. SARCINA Goodsir (1842) — Thiosarcina *Winogradsky* (1888).

Cocchi aggregati ad 8 ad 8 in famiglie pacchettiformi, cubiche. Ganga gelatinosa tenuissima. Temnogenesi in tre direzioni.

A — *Non liquefano la gelatina.*

1. **S. ventriculi** Goodsir (Merismopedia Goodsirii *Husem.*).
2. **S. lutea** Flügge (Mikroorgan., p. 179, fig. 59, 60).
3. **S. Virchowii** Trev. (Atti dell' Accad. Fisio-medica-statistica di Milano, Ser. IV, Vol. III, p. 119, 1885).

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28

B — *Liquefano la gelatina.*

4. **S. maxima** Lindner (1888).
5. **S. candida** Lindner (1888).
6. **S. flava** De Bary (S. liquefaciens *G. C.* and *P. F. Frankland*, 1888).
7. **S. aurantiaca** Flügge (Mikroorgan., p. 180).
8. **S. rosea** Schröter (S. sulphurata *Winogradsky*, 1887).

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9. **S. urinae** Welcker (S. renis *Hepworth*, 1857).
10. **S. intestinalis** Zopf (Spaltpilze, p. 55, 1885).

Gen. XXXV. PEDIOCOCCUS Lindner (1887) — Erythroconis *Oersted* (1842); Thiopedia *Winogradsky* (1888).

Cocchi aggregati a 4 a 4 in famiglie unistrate nella ganga gelatinosa equabilmente spianata a guisa di membranella parallelogrammica. Temnogenesi in due direzioni.

§ 1. **Merismopediodi.**

1. **P. hyalinus** Trev. (Merismopedia hyalina *Kützing*).
2. **P. roseus** Trev. (Thiopedia rosea *Winogradsky*, 1888).
3. **P. litoralis** Trev. (Erythroconis litoralis *Oersted*, 1842).
4. **P. Reichenbachii** Trev. (Sarcina Reichenbachii *Corn.* et *Bab.*, Bactér., p. 134).
5. **P. violaceus** Trev. (Merismopedia violacea *Kützing*).

§ 2. **Eupediococchi.**

6. **P. cerevisiae** Lindner, 1887 (Sarcina der Biere *R. Koch*).
7. **P. acidi-lactici** Lindner (1887).
8. **P. albus** Lindner (1888).
9. **P. Kochii** Trev. (Mikrokok. in Wundsecreten bei Menschen *R. Koch*).
10. **P. aurantiacus** Trev. (Micrococcus aurantiacus *Pagliani, Maggiora* e *Fratini*, 1887).

Gen. XXXVI. THIOCAPSA Winogradsky (1888).

Cocchi lassamente aggregati in famiglie irregolari nella ganga mucosa disugualmente spianata senza forma definita. Temnogenesi in tre direzioni.

1. **Th. roseo-persicina** Winogradsky (Beitr., p. 84, tav. 4, fig. 15).

Trib. VII. **STREPTOCOCCEE** Trev.

Cocchi seriati in filamenti.

Gen. XXXVII. LEUCONOSTOC Van Tieghem (1878).

Cocchi globulosi (monococchi) seriati in filamenti moniliformi, semplici, racchiusi in ampie e crassissime capsule membranaceo-gelatinose. Spore macrosome provenienti nei filamenti.

1. **L. mesenteroides** Van Tieghem (Ascococcus mesenteroides *Cienkowski*).

Gen. XXXVIII. SCHÜTZIA Trev.

Cocchi globulosi o per incipiente temnogenesi brevemente ellissoidi (monococchi), seriati in filamenti moniliformi, semplici, racchiusi in tenui capsule membranaceo-gelatinose. Spore macrosome provenienti nei filamenti.

1. **Sch. Poelsii** (*) Trev. (Streptococcus der Druse der Pferde *Schütz*, 1887).
2. **Sch. Laughlini** Trev. (Micrococcus of Dengue, *Mc Laughlin*, 1886).
3. **Sch? Dissei** Trev. (Diplococcus der Japanischer Syphilis *J. Disse*, 1887).

Gen. XXXIX. PERRONCITOA Trev.

Cocchi compressi (**) seriati lateralmente a due a due (diplococchi trasversali) in filamenti semplici rivestiti di vagine cilindriche membranaceo-gelatinose. Spore macrosome provenienti nei filamenti.

La forma compressa dei cocchi, appaiati a guisa delle Neisserie, è affatto speciale. Quando si liberano dalla vagina divengono perfettamente globulosi.

1. **P. scarlatinosa** Trev. (Micrococcus scarlatinosus *Trev.*, Batteri italiani, p. 19, 1879; Streptococcus rubiginosus *Edington*, 1887).

Gen. XL. BABESIA Trev.

Cocchi ellissoidi seriati longitudinalmente a due a due (diplococchi longitudinali) in filamenti moniliformi, ramosi, non racchiusi in capsule nè rivestiti di vagine. Spore macrosome provenienti all'estremità dei filamenti.

1. **B. xanthopyrethica** Trev. (Bactérie de la fièvre jaune *Babes*, 1883; *De Lacerda*, 1887 — *Corn.* et *Bab.*, Bactér., fig. 32, 242, 243, 244, 245, 246).
2. **B. erysipeloidis** Trev. (Coccus della erisipeloide o erisipela cronica *Rosenbach*, 1887). Cocchi globuloso-ellissoidi seriati in filamenti pseudodicotomi. Spore terminali.

Gen. XLI. STREPTOCOCCUS F. Cohn (1875) — Arthrobacterium *De Bary* (1887).

Cocchi globulosi o brevissimamente ellissoidi (monococchi) seriati in filamenti moniliformi, semplici, non racchiusi in capsule nè rivestiti di vagine. Spore macrosome provenienti nei filamenti.

§ 1. Streptococchi zoobii patogeni in malattie contagiose.

* Streptococchi in malattie contagiose dell'uomo.

1. **Str. erysipelatos** Zopf (Micrococcus erysipelatos *Fehleisen*).

(*) È al dott. J. Poels di Rotterdam che devesi la scoperta dei caratteri essenziali pei quali da tutti gli altri generi di Streptococcee distinguesi questa specie, a quanto pare prima di ogni altre osservata dal prof. Schütz.

(**) « *Comprime. (compressus)* se dit des solides dont la coupe transversale présente la forme d'une ellipse, comme s'ils avaient été serrés par les côtes. » — De Candolle A.-P., Théorie élémentaire de la botanique, pag. 487.

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30

2. **Str. morbillosus** Trev. (Micrococcus morbillosus *Trev.*, 1879).
3. **Str. variolae** Trev. (Micrococcus variolae *F. Cohn*, 1872).
4. **Str. varicellae** Trev. (Microbio della varicella *Bareggi*, 1885).
5. **Str. Lucae** Trev. (Micrococcus ulceris mollis *R. de Luca*, 1886).

*** Streptococchi in malattie contagiose degli animali.

6. **Str. bovinus** Trev., 1885 (Micrococcus bovinus *Trev.*, 1879). Streptococco della peste bovina.
7. **Str. Weissii** Trev., 1885 (Streptococco della pleuropneumonia contagiosa, « Polmonera », dei bovini).
8. **Str. suspectus** Trev. (Streptococco dell'ematuria, « Piscia-sangue », dei bovini).
9. **Str. Nocardi** Trev. (Microbe de la mammite contagieuse des vaches laitieres *Nocard* et *Mollereau*, 1887).
10. **Str. ambratus** Trev. (Micrococco ambrato *Perroncito*, 1885).
11. **Str. vitulorum** Trev. (Micrococco della diarrea bianca dei vitellini *Perroncito*, 1886).
12. **Str. aphthicola** Trev. (Streptococco dell'afta epizootica, « taglione », dei bovini).
13. **Str. influentiae** Trev. (Streptococco dell' « influenza » del cavallo).
14. **Str. hydrophoborum** Trev. (Streptococcus bei Rabies *Babes*, Zeitschr. für Hygiene, V Bd., 1888, p. 184, 188, tav. II, fig. 9).
15. **Str. perniciosus** Zopf (Spaltpilze, p. 53).
16. **Str. Bombycis** Zopf (Microzyma Bombycis *Béchamp*, 1868).

§ 2. Streptococchi zoobii patogeni in malattie non contagiose.

Streptococchi in malattie non contagiose dell'uomo.

17. **Str. pyogenes** Rosenbach, 1884 (Streptococcus pneumoniae *Weichselbaum*, 1887).
18. **Str. septo-pyaemicus** Biondi (1887).
19. **Str. malignus** Trev. (Streptococcus pyogenes malignus *Flügge*, Mikroorgan., p. 153).
20. **Str. articulorum** Flügge (Streptococcus diphtheriticus *Zopf*).
21. **Str. Rindfleischii** Trev. (Streptococcus bei Mycosis fungoides *Rindfleisch*).
22. **Str. nomae** Trev. (Microcoque dans le Noma *Corn.* et *Bab.*, Bacter., p. 123, 394, tav. I, 3me rangée).
23. **Str. dentium** Trev. (Micrococcus dentium *Trev.*, Batt. ital., p. 27, 1879; Micrococcus foetidus *Flügge*, 1886).

** Streptococchi in malattie non contagiose degli animali.

A — *In malattie naturali.*

24. **Str. Charrini** Trev. (Microbe de la septicémie consécutive au charbon *Charrin*, 1884).

B — *In malattie sperimentali.*

25. **Str. Kochii** Trev. (Micrococcus der Septikämie bei Kaninchen *R. Koch*).
26. **Str. necroticus** Trev., 1885 (Micrococcus der progressiven Gewebsnekrose bei Mäusen, *R. Koch*).

§ 3. Streptococchi zimogeni.

27. **Str. fermenti** Trev. (Torulacée du vin filant *Pasteur*, 1861; Micrococcus fermenti *Trev.*, Batteri italiani, p. 19, 1879; Micrococcus viscosus *Flügge*, 1886).
28. **Str. zythi** Trev. (Torulacée de la bière malade *Pasteur*).
29. **Str. Schmidti** Trev. (Streptococco del latte filante).
30. **Str. ureae** Trev. (Micrococcus ureae *F. Cohn*).
31. **Str. aëthebius** Trev. (Micrococcus ureae liquefaciens *Flügge*).
32. **Str. ochroleucus** Trev. (Micrococcus ochroleucus *Prove*).

§ 4. Streptococchi saprofiti.

33. **Str. phosphoreus** Trev. (Micrococcus phosphoreus *F. Cohn*, 1878; Bacterium lucens *Nuesch*, 1880; Micrococcus Pflügeri *Ludwig*, 1884; Arthrobacterium Pflügeri *De Bary*, 1887).
34. **Str. saprogenes** Trev. (*Flügge*, p. 172, fig. 58 *a* sinistr.).
35. **Str. haematosaprus** Trev. (*Flügge*, p. 173, fig. 58 *a* destr.).
36. **Str. putrefaciens** Trev. (*Flügge*, p. 173, fig. 58 *a* med.).
37. **Str. alvearis** Trev. (Cryptococcus alvearis *Preuss*). Streptococco della « marciaia » delle api).

§ 5. Streptococchi di cui non si conoscono le proprietà specifiche.

A — *Coprobio.*

38. **Str. merdarius** Trev. (Streptococcus des selles *Com.* et *Babes.* Bactér., p. 118, fig. 23).

B — *Comparsi a caso nelle culture.*

39. **Str. radiatus** Trev. (Micrococcus radiatus *Flügge*, Mikroorganismen. p. 176).
40. **Str. desidens** Trev. (Micrococcus flavus desidens *Flügge*).
41. **Str. cinnabareus** Trev. (Micrococcus cinnabareus *Flügge*).
42. **Str. violaceus** Trev. (Micrococcus violaceus *F. Cohn*).

C — *Ottenuto da culture dei terreni.*

43. **Str. septicus** Flügge (Mikroorganismen, p. 154).

D — *Ottenuto da culture delle acque.*

44. **Str. Malaperti** Trev. (Micrococcus « *E* » de l'eau minérale des sources chaudes de Schlangenbad *Malapert-Neuville*, 1887).

E — *Ottenuti da culture dell'aria.*

45. **Str. coronatus** Trev. (Micrococcus coronatus *Flügge*). Liquefa la gelatina.
46. **Str. liquefaciens** G. C. and P. F. Frankland (1888). Liquefa la gelatina.
47. **Str. aerophilus** Trev. — Colonie rotonde, gialle, di lento sviluppo nella gelatina. Filamenti di cocchi di 0,4, 2 diam., che non si coloranò che appena o punto coi colori di anilina. Non liquefa la gelatina.

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32

Trib. VIII. **MICROCOCCEE** Trev. (1887). — Cocchi non mai racchiusi nè in cisti nè in capsule membranaceo-gelatinose, solitari o appaiati, o aggregati senz'ordine in colonie irregolari più o meno mucose, ora a guisa di grappoli informi, ora di stormi o a modo di zoogiee.

Gen. XLII. NEISSERIA Trev. (Caratteri di alcuni nuovi generi di Batteriacee, p. 16, 1885).

* Antropobie.

A — *Nessun sviluppo sulla gelatina a circa 22°.*

1. **N. gonorrhoeae** Trev., l. cit., p. 16 (Micrococcus der Gonorrhoe *Neisser*, 1879).

B — *Non liquefano la gelatina.*

2. **N. albicans** Trev. (Micrococcus albicans amplus *Flügge*).
3. **N. lactea** Trev. (Micrococcus lacteus faviformis *Flügge*).
4. **N. tardissima** Trev. (Diplococcus albicans tardissimus *Flügge*).
5. **N. Edigtoni** Trev. (Diplococcus scarlatinae sanguinis *Edington*).
6. **N. Micheli** Trev. (Trachomcoccus *Michel*, 1886).
7. **N. citrea** Trev. (Micrococcus citreus conglomeratus *Flügge*).

C — *Liquefano la gelatina.*

8. **N. rebellis** Trev. (Micrococcus in Trachoma folliculare *Kucharsky*, 1887).
9. **N. Winkleri** Trev. (Micrococcus bei Beri-Beri *Pekelharing* e *Winkler*, 1887).
10. **N. Weichselbaumii** Trev. (Diplococcus intracellularis meningitidis *Weichselbaum*, 1887).
11. **N. subflava** Trev. (Micrococcus subflavus *Flügge*).

** Zoobia.

12. **N. Babesi** Trev. (Bactér. de l'hémoglobinurie du boeuf *Babes*, 1888).

*** Idrobia.

13. **N. lutea** Trev. (Diplococcus luteus *Adametz*, 1887).

**** Aerofita.

14. **N. rosea** Trev. (Micrococcus roseus *Flügge*).

Gen. XLIII. STAPHYLOCOCCUS Rosenbach (1884) — Spore microsome.

A — *Liquefano la gelatina.*

1. **St. Biskrae** Trev. (Microbe du Bouton de Biskra *Duclaux*, 1884).
2. **St. pyogenes** var. α **aureus** Rosenbach.
   var. β **flavescens** Trev. (Staphylococcus flavescens *Babes*).
   var. γ **citreus** Passet.
   var. δ **albus** Rosenbach.
3. **St. pyosepticus** Héricourt et Richet (1888).
4. **St. sialopyus** Trev. (Staphylococc. salivarius pyogenes *Biondi*, 1887).

B — *Non liquefano la gelatina.*

5. **St. cereus** Trev. (Staphylococcus cereus albus *Passet*; Staphylococcus albus non liquefaciens *Hlava*, 1887).
6. **St. Passeti** Trev. (Staphylococcus cereus flavus *Passet*).

7. **St. viridi-flavescens** Guttmann (1887).
8. **St. Leloiri** Trev. (Microbe des périfolliculites conglomérées *Leloir*, 1884).
9. **St. candidus** Warrington (The Lancet, 1888, Vol. I, N. 25).

Gen. XLIV. MICROCOCCUS Zopf (riform.) — Spore microsome.

§ 1. Micrococchi patogeni in malattie dell'uomo.

* Micrococchi endogeni.

A — *Incolori.*

1. **M. petechialis** Trev. (Batteri italiani, p. 19, 1879; Micrococco del dermotifo *Bareggi*, 1886).
2. **M. Löwenbergii** Trev. (Micrococcus de l'ozène *Löwenberg*, 1884).
3. **M. conglomeratus** Weichselbaum (1887).
4. **M. Manfredii** Trev. (Micrococcus del linfoma progressivo *L. Manfredi*, 1886).
5. **M. sialosepticus** Trev. (Coccus salivarius septicus *Biondi*, 1887).

B — *Pigmentari.*

6. **M. Burchardti** Trev. (Coccus bei keratitis phlyctaenulosa *Burchardt*, 1887).
7. **M. haematodes** Zopf (Spaltpilze, p. 60).

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8. **M. capillorum** Trev. (Zoogloea capillorum *Rabenhorst*).

** Micrococchi esogeni in malattie miasmatico-contagiose.

9. **M. xanthogenicus** Trev. (Cryptococcus xanthogenicus *Freire*).

*** Micrococchi in malattie contagiose che l'uomo può contrarre dagli animali.

10. **M. Lyssae** Trev., Batter. ital., p. 20, 1879 (Cocco-bacterium Lyssae *Rivolta*, 1886). Sporifero!

§ 2. Micrococchi patogeni in malattie degli animali.

* In malattie naturali.

11. **M. porcellorum** Trev. (Micrococcus bei Hepatitis enzootica porcellorum *Nowewitsch*, 1888).
12. **M. mastobius** Trev. (Microcoque de la mammite gangréneuse des brebis laitières *Nocard*, 1887).

** In malattie sperimentali.

13. **M. haematosaprus** Trev. (Micrococcus der progressiven Abscessbildung bei Kaninchen *R. Koch*).
14. **M. petilus** Trev. (Micrococcus der Pyämie bei Kanichen, *R. Koch*).

§ 3. Micrococchi normalmente viventi innocui nell'uomo.

15. **M. Fickii** Trev. (Coccus albus non liquefaciens *Fick*, 1888).
16. **M. magnus** Trev. (Jodococcus magnus *W. Miller*, 1888).
17. **M. parvus** Trev. (Jodococcus parvus *W. Miller*, 1888).

§ 4. Micrococchi piogeni.

18. **M. Rosenbachii** Trev. (Micrococcus pyogenes tenuis *Rosenbach*).

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§ 5. Micrococchi zimogeni.

19. **M. gelatinosus** Warrington (1888).

§ 6. Micrococchi saprofiti.

* Incolori.

20. **M. Crepusculum** F. Cohn, 1872 (Monas Crepusculum *Ehrenb.*).
21. **M. Pasteuri** Trev. (Microbe pyogène de l'eau de Seine *Pasteur*).
22. **M. Boleti** Passerini (Erbar. crittogam. italiano, ed. II, N. 1199).

** Pigmentari.

23. **M. fulvus** F. Cohn (1875).
24. **M. mirificus** Trev., 1879 (Palmella mirifica *Rabenhorst*, 1856).
25. **M. aurantiacus** F. Cohn (Bacteridium aurantiacum *Schröter*).
26. **M. luteus** F. Cohn (Bacteridium luteum *Schröter*).
27. **M. chlorinus** F. Cohn (1872).
28. **M. cyaneus** F. Cohn (Bacteridium cyaneum *Schröter*).

§ 7. Micrococchi di cui non si conoscono le proprietà specifiche, ottenuti sopra substrati di cultura.

* Comparsi a caso nelle culture.

A — *Incolori.*

29. **M. viticulosus** Flügge (Mikroorganismen, p. 178).
30. **M. candicans** Flügge (l. cit., p. 173). Non liquefà la gelatina.

B — *Pigmentari.*

31. **M. versicolor** Flügge (Mikroorganismen, p. 177).
32. **M. flavus** Trev. (Micrococcus flavus liquefaciens *Flügge*).
33. **M. tardigradus** Trev. (Micrococcus flavus tardigradus *Flügge*).

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34. **M. putridus** Tilanus (München. medic. Wochenschrift, 1887).

** Ottenuti da culture dei terreni.

35. **M. roseus** Pagliani, Maggiora e Fratini (1887).

*** Ottenuti da culture delle acque.

36. **M. aquatilis** Meade Bolton (1886).
37. **M. fervitosus** Adametz und Wichmann (1888).
38. **M. Neuvillei** Trev. (Micrococcus *G* de l'eau minéral de Stahlbrunnen *Malapert-Neuville*, 1887).

**** Ottenuti da culture dell'aria.

A — *Non liquefano la gelatina.*

39. **M. albus** G. C. and P. F. Frankland (1888).
40. **M. decipiens** Trev. (Bactérie de l'air *Cornil* et *Babes*, Bact., p. 124).

B — *Liquefano la gelatina.*

41. **M. gigas** G. C. and P. F. Frankland (1888).
42. **M. Franklandiorum** Trev. (Micrococcus candicans G. C. and P. F. Frankland (1888), non Flügge (1886).
43. **M. chryseus** G. C. and P. F. Frankland (1888).
44. **M. carnicolor** G. C. and P. F. Frankland (1888).
45. **M. rosaceus** G. C. and P. F. Frankland (1888).

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

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THE GENERIC CLASSIFICATION OF THE SOIL CORYNEBACTERIA

Francis E. Clark*

The transfer by Murray et.al. (1) of the genus Corynebacterium from the order Actinomycetales to the Eubacteriales, its separation from the genus Mycobacterium with which it had been closely grouped for many years, and the inclusion within the genus Corynebacterium of a number of species of soil, cellulolytic, and phytopathogenic bacteria previously assigned to other genera, are indicative of the present unsettled taxonomy of the corynebacteria.** One need look no further than the reference already cited for such statements as "the reports of motile species in this genus present a puzzling problem" and "the relationship of the following soil organism (Bacterium globiforme) is not clear, but it apparently should be placed either in Corynebacterium or in a related genus (e.g., Mycobacterium.)"

The latter statement focuses one part of the problem especially sharply, inasmuch as in the Bergey Manual (2) the "related genus", after a half century of association, is found not merely in a separate family, but even in a separate order. It is also of interest to note that although Conn contributed Appendix III of Corynebacterium to the Manual, he immediately published elsewhere (3), assigning the appended group of globiform bacteria to the order Actinomycetales.

Several recently published expressions of dissatisfaction with the taxonomy of the soil and plant corynebacteria, the appearance of some alternative schemes of classification, and the accumulation of some additional observations concerning the morphology and physiology of this group of microorganisms have made it appear desirable to review current problems in the taxonomy of the soil corynebacteria and of certain closely related bacteria.

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** The term corynebacteria is here used as a convenient designation to include not only species which may be placed in the genus Corynebacterium but also those which may be placed in closely related genera. It may be regarded as substantially equivalent to the family Corynebacteriaceae. Similarly the name mycobacteria includes not only organisms placed in the genus Mycobacterium but also those in other closely related genera of the Mycobacteriaceae.

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Has The Genus Corynebacterium Become Unwieldy?

The difficulty of separating corynebacteria of animal origin from gram-positive, pleomorphic bacteria from other sources was apparent to Lehmann and Neumann (4) and to many succeeding writers. The saprophytic corynebacteria that occurred in soil, air, and water were considered clinically unimportant, and they received very little attention from medical bacteriologists. For the most part, soil bacteriologists gave their attention to bacteria accomplishing mineral nutrient transformations believed important in soil productivity. A few workers, however, directed their efforts to a study of the general soil microflora, and in the course of their work, an ever greater variety of microorganisms has been assigned to Corynebacterium.

The work of Jensen (5) played an especially important part in the development of a trend to broaden Corynebacterium to include therein a number of bacteria of soil and plant origin. Following careful study of the morphology and physiology of the small angular rods predominant in soil, Jensen (5) described several of them as new species in the genus Corynebacterium. In addition, he established new combinations in Corynebacterium to accommodate seven species previously assigned to four other genera. The species transferred to Corynebacterium were the following: Aplanobacter insidiosum McCulloch, A. michiganense Erwin F. Smith; Bacterium helvolum (Zimmermann) Lehmann and Neumann, B. nubilum (Frankland) Lehmann and Neumann; Cellulomonas fimi (McBeth and Scales) Bergey et.al.; Microbacterium lacticum Orla-Jensen, and M. liquefaciens Orla-Jensen. These several new combinations were made by Jensen because of his firm belief that the bacteria concerned formed a natural and consistent group.

Plant pathologists showed a willingness to follow the suggestion of Jensen (5) that certain phytopathogenic bacteria should be designated as corynebacteria. Skaptason and Burkholder (6) transferred Bacterium sepedonicum Spieckermann and Kotthoff, the organism causing bacterial ring rot of potatoes, to Corynebacterium. Dowson (7) made new combinations in Corynebacterium to accommodate Aplanobacter rathayi Erwin F. Smith, Bacterium flaccumfaciens Hedges, and Phytomonas fascians Tilford. Starr and Pirone (8) described the new species Corynebacterium poinsettiae as the cause of a disease of the common ornamental poinsettia. Murray et.al. (1) recognized these several new combinations or species, and in addition, made new combinations to place in Corynebacterium the following: Aplanobacter agropyri O'Gara, Pseudomonas hypertrophicans Stahel, and Pseudomonas tritici Hutchinson.

In addition to their recognition of phytopathogenic corynebacteria and of several saprophytic corynebacteria from soil as members of the

genus Corynebacterium, Murray et al. (1) recognized the transfer of a cellulolytic bacterium from Cellulomonas to Corynebacterium. Jensen (5) had observed that Cellulomonas fimi showed plainly the morphology of the corynebacteria, and accordingly transferred this species to Corynebacterium. He did not at the same time have available for study additional cultures labelled Cellulomonas. Later, Clark (9) obtained stock cultures of several species of Cellulomonas and found them to show no generic distinction from Corynebacterium fimi. The question was thus raised whether or not these additional cellulolytic bacteria were also to be grouped generically with the soil corynebacteria.

In 1928, Conn (10) described the species Bacterium globiforme as representative of the pleomorphic, gram-variable, slow-growing bacteria in soil. This species subsequently was designated as Achromobacter globiforme, order Eubacteriales, by Bergey et.al. (11). Bacteria undoubtedly identical with the globiform group of Conn were placed in Mycobacterium by Krassilnikov (12). Following the work of Jensen (5), the close relationship of the globiform group to Corynebacterium became generally recognized. In the sixth edition of Bergey's Manual (2), soil species such as Corynebacterium helvolum and C. tumescens were placed in Corynebacterium, and Bacterium globiforme was placed in an appendix to the genus. Recently, Wood (13) has proposed Corynebacterium globiforme as a new combination.

It is obvious that Corynebacterium has come to include many bacteria formerly found in other genera. Conn (14) and Conn and Dimmick (3) objected to the inclusion of an ever greater variety of organisms in Corynebacterium. Murray et.al. (1) and Cowan (15) have also admitted dissatisfaction with the present composition of the genus Corynebacterium. One criticism commonly raised is based upon the taxonomic principle that a genus is exemplified specifically by its type. Many of the corynebacteria of soil and plant origin differ markedly from C. diphtheriae. Therefore, it appears unacceptable to many to place in Corynebacterium gram-variable, pleomorphic bacteria that possess flagella, or grow well on inorganic sources of nitrogen, or liquefy gelatin or attack cellulose, or even fail to grow at 37° C. It can be argued that the differences between C. diphtheriae and Mycobacterium tuberculosis are no greater.

It is the writer's opinion that with the gradual extension of its generic limits to include a diversity of bacteria, Corynebacterium as currently defined has become an undesirable and an unwieldy genus.

To What Genus Do The Soil Corynebacteria Belong?

If Corynebacterium is rejected as the generic name for the soil diptheroids, the question then arises whether or not there exists any

genus to which these bacteria properly can be assigned. Conn and Dimmick (3) have proposed that the soil corynebacteria be designated as Arthrobacter. This name was used by Fischer (16) for non-flagellate rod-shaped bacteria producing "arthrospores." No type was described, and the genus cannot be considered to have been validly published prior to 1947. Therefore the genus should be recognized as Arthrobacter Conn and Dimmick, and not as an emendation of Arthrobacter Fischer, as Conn and Dimmick (3) have proposed.

It is believed desirable to remove the soil globiform organisms from Corynebacterium, and Arthrobacter appears to be an acceptable alternative designation. Lochhead (17) has commented on Arthrobacter as follows: "The accommodation of the Bacterium globiforme group in a separate genus has much to commend it, by avoiding undue extension of the commonly held definition of Corynebacterium, while providing for an important group of related forms."

Arthrobacter has been described rather fully by Conn and Dimmick (3), and its complete description need not be repeated here. In my experience, the published description for Arthrobacter, with an exception concerning motility to be discussed shortly, has been found adequate for globiform cultures obtained from widely scattered laboratories in America and abroad, and for many cultures from soil. According to its authors (3), Arthrobacter liquefies gelatin, fails to produce acid from fermentable sugars, and grows well on synthetic media--in contrast to animal diptheroids. Corynebacterium cultures obtained from veterinary laboratories almost without exception have been differentiable culturally from cultures of Arthrobacter. The finding of occasional intermediate strains that are difficult to classify is by no means limited to the group of bacteria under discussion, nor does it invalidate the use of Arthrobacter for the soil corynebacteria.

Arthrobacter was described by Fischer (16) as nonmotile; Conn and Dimmick (3) failed to mention motility for any of the species they placed in this genus. Of eight cultures of Arthrobacter received from Conn, two have been found to be motile (18). Subsequently Conn in a personal communciation commented that he had intentionally omitted motility from the generic description, although he himself had not observed motile strains. Reports of motility for the soil corynebacteria are sufficiently numerous (13, 18, 19, 20, 21) to show that motility must be recognized within this group.

Bisset and Moore (22) also believed the soil corynebacteria sufficiently dissimilar from C. diphtheriae to preclude their assignment to the same genus. They proposed the genus Jensenia to include the soil

diptheroids. Unfortunately, they ignored the extended and very valuable earlier work of Conn, Jensen, and others, and apparently failed to undertake studies of any named cultures from other laboratories. In their initial paper (22) on Jensenia, the genus was proposed without designation of type species. After this omission was called to their attention, the genus was again described, with Jensenia canicruria (23) as the type. This species was described as failing to hydrolyze polysaccharides or proteins, and also, as failing to reduce nitrates. Inasmuch as Arthrobacter globiformis is positive in all these respects, it appeared probable that the two species would prove to be entirely dissimilar. This was found to be true on actual examination. Jensenia canicruria (N.C.I.B. culture no. 8147) has been found to agree with its published description in its general physiological responses. Morphologically, the culture appears to be a Nocardia. Jensenia cannot be considered as synonymous with Arthrobacter.

The writer has found culture no. 64 of Topping (19) to be identical with J. canicruria 8147. Topping (19) placed her culture no. 64 in a group designated "2b, gram-positive, nonmotile, mycelium-forming", and she remarked further: "It is clear that the organisms described in this paper under Group 2b are members of the Jensen's genus Proactinomyces" (i.e., Nocardia).

It is probable that Bisset and Moore, in speaking of the "soil diptheroids", either were dealing only with Nocardia, or they grouped the non-mycelium-forming and the mycelium-forming soil organisms into a single genus. Any such action appears highly questionable at the present time.

The Cellulolytic Soil Corynebacteria

That certain of the soil bacteria capable of attacking cellulose are in fact corynebacteria has been recognized by Jensen (5), Harmsen (24), and Clark (9). Production of cellulase is known among many taxonomic groups; it should be given no greater taxonomic emphasis than other physiological characteristics. If the cellulolytic corynebacteria were entirely similar to Arthrobacter except for cellulase activity, it probably would be desirable to group them all into a single genus. Inasmuch as Cellulomonas was validly described some twenty years earlier than was Arthrobacter, it would be necessary to retain Cellulomonas as the generic designation for the combined group.

Such consolidation into a single genus does not appear to be necessary. Arthrobacter and Cellulomonas differ in certain respects other than their cellulolytic activity. All species of Cellulomonas available for study have produced distinct acidity in dextrose nutrient broth, they have shown scant growth on synthetic media, and they have been unable to hydrolyze urea or uric acid. In view of these differences, it is

believed that both genera Cellulomonas and Arthrobacter should be maintained.

Inasmuch as Cellulomonas initially was described to include a number of cellulolytic bacteria, some of which have since been removed to other genera, the generic description given in Bergey's Manual (2) no longer is entirely satisfactory:- "Small rods with rounded ends, non-spore-forming, motile with peritrichous flagella, occurring in soil and having the property of digesting cellulose. Growth on ordinary culture media often not vigorous. Gram-negative."

The following emendation is proposed:
Cellulomonas Bergey et.al., emend. Small pleomorphic rods, straight to angular or slightly curved, with occasional beaded, clubbed, branched, or coccoid cells, the number of such cells depending on the age and condition of the subculture. Motile with one or few peritrichous flagella; some species are nonmotile. If only a single flagellum is present, it usually is polar. Gram-reaction variable. Growth on ordinary culture media often not vigorous; otherwise, growth on solid media u usually soft and smooth, and in broth, turbid. Yellow pigmentation common; other pigments also occur. Gelatin slowly hydrolyzed. Catalase positive. Acid but no gas from carbohydrates; cellulose commonly attacked. Typically of soil or plant origin.

The type species is Cellulomonas biazotea (Kellerman) Bergey et.al.

Heretofore, the genus Cellulomonas has been placed in the family Bacteriaceae. The emended genus is placed in the family Corynebacteriaceae.

The Phytopathogenic Corynebacteria

Those workers who have objected to the use of Corynebacterium for the soil corynebacteria have also objected to its use for the phytopathogenic corynebacteria. Conn and Dimmick (3), following study of several phytopathogenic species, concluded that, with the possible exception of Corynebacterium michiganense, the cultures showed such differences from the type C. diphtheriae that they clearly belonged elsewhere. More recently, Cowan (15) has proposed that the motile phytopathogens, such as C. flaccumfaciens, should be removed from Corynebacterium.

Currently, there appear three alternatives for the generic designation of the phytopathogenic corynebacteria: (a) these bacteria can be retained in Corynebacterium; (b) they can be placed in Cellulomonas; or (c) they can be established in a new genus in the family Coryne bacteriaceae. Their gram variability, cell morphology, and cultural

properties preclude their return to such genera as Bacterium or Pseudomonas, where some of them have at times been placed. The genus Arthrobacter as defined by Conn and Dimmick (3) did not include the phytopathogenic corynebacteria. If Arthrobacter is defined sufficiently narrowly to eliminate confusion with Cellulomonas, then its definition will also exclude the phytopathogenic corynebacteria.

In order to avoid premature establishment of new combinations or of additional names, the first alternative, retention in Corynebacterium, is followed for the present. Nevertheless it is believed that the allocation of the phytopathogenic corynebacteria to Cellulomonas would be preferable to their placement in Corynebacterium. In general they show greater similarity to Cellulomonas biazotea than to Corynebacterium diphtheriae. Attention has been called recently to the similarity in the motility and flagellation of phytopathogenic and celluloytic corynebacteria (18).

It is also possible that the phytopathogenic corynebacteria should be recognized in a separate genus, distinguished from Cellulomonas by their phytopathogenicity and by their lack of cellulase activity. In this connection possibly Corynemonas, at one time suggested by Orla-Jensen (25) as a name for the corynebacteria, could be suitably validated and employed. Inasmuch as action in accord either with this or with the second alternative given above appears desirable, it is to be hoped that some such action will be taken by competent students of this group, in order that the genus Corynebacterium can be divested of the phytopathogenic bacteria which differ so markedly from C. diphtheriae.

To What Family And Order Do The Corynebacteria Belong?

Corynebacterium Lehmann and Neumann 1896, together with Mycobacterium and Oospora, were placed by its authors (26) in the Hyphomycetes, their fourth major grouping of microorganisms. In the second edition of the Lehmann and Neumann Manual (27), Oospora was replaced by Actinomyces, and Hyphomycetes by Actinomycetes. In the seventh edition (28), Corynebacterium and Mycobacterium comprised the family Proactinomycetaceae in the order Actinomycetales.

The extent to which the schemes of other taxonomists, during the period 1896 to 1927, deviated from the proposals of Lehmann and Neumann has been adequately summarized in the introductory pages of Bergey's Manual (2). For the most part, Corynebacterium and Mycobacterium were included in the same family, and usually in the order Actinomycetales. There were relatively few expressions of disagreement. Notably, Winslow et.al. (29) recognized six genera in the family Mycobacteriaceae in the order Eubacteriales. The genera so

grouped were the following: Corynebacterium, Mycobacterium, Nocardia, Fusiformis, Actinomyces, and Leptotrichia. Their proposed placement of these genera in Eubacteriales was not generally accepted in the years immediately following publication.

In agreement with the outline classification of Lehmann and Neumann, Bergey et.al. (3) placed the family Mycobacteriaceae, including Corynebacterium and Mycobacterium, in the order Actinomycetales. Four succeeding editions of the Bergey Manual retained this allocation of the genus Corynebacterium. Nor was the taxonomic treatment accorded to the genus by Pringsheim (31), Janke (32), or Pribram (33) greatly different.

Recently, and concurrently with the trend to broaden Corynebacterium to include many bacteria formerly allocated to other genera, there again have appeared some suggestions that the genus Corynebacterium should be assigned to the Eubacteriales and not to the Actinomycetales. Kluyver and Van Niel (34) recognized the Mycobacteriaceae as a family of permanently nonmotile rod-shaped bacteria, and proposed to include therein two tribes, the Corynebacterieae and the Mycobacterieae. Stanier and Van Niel (35) also included both Mycobacterium and Corynebacterium in the Eubacteriales. In criticism of the Bergey's Manual (36) they stated that the inclusion of these genera in Actinomycetales leads to confusion, since these forms can so readily be taken for representatives of the Eubacteriales. On the other hand, they admitted that the the dividing line between the genera Mycobacterium and Nocardia was a tenuous one.

Although Stanier and Van Niel (35) had included both the mycobacteria and the corynebacteria in Eubacteriales, Breed et.al. (2) separated the two genera, placing Corynebacterium in Eubacteriales, and Mycobacterium in Actinomycetales.

Several workers have raised objection to any such assignment and separation of the corynebacteria and the mycobacteria. Conn and Dimmick (3) preferred the classification given in the fifth edition of Bergey's Manual to that proposed in the sixth edition; they regarded the two genera as closely related. They believed that the Mycobacteriaceae should be divided into three genera, namely, Mycobacterium, Corynebacterium, and Arthrobacter.

Bisset and Moore (22) grouped Mycobacterium, Corynebacterium, and Nocardia in the family Mycobacteriaceae, and the genus Actinomyces and the newly proposed genus Jensenia in the family Actinomycetaceae, with both families in the order Actinomycetales.

Cowan (15) also placed Mycobacterium, Corynebacterium, and Nocardia, as well as Erysipelothrix and Kurthia, in the family Mycobacteriaceae, but he proposed that this family be placed in a separate order, Mycobacteriales. The families Actinomycetaceae and Propionibacteriaceae comprised the order Actinomycetales.

Altogether, it appears from the recent literature that the majority of those who have worked with the corynebacteria oppose any transfer of this group to the Eubacteriales, and in addition oppose any wide separation of the mycobacteria and the corynebacteria. The fact that certain species now grouped with the corynebacteria have in the past been grouped with the eubacteria hardly seems a sufficient argument for placing all corynebacteria in Eubacteriales. Cowan's proposal (15) that the corynebacteria and mycobacteria be placed in a new order Mycobacteriales appears worthy of endorsement. With the currently proposed grouping of the corynebacteria into several genera (Corynebacterium, Arthrobacter, Cellulomonas), the retention of the family Corynebacteriaceae also appears desirable.

Summary

The genus Corynebacterium Lehmann and Neumann (type species Corynebacterium diphtheriae) should be so defined as to exclude many corynebacteria of soil and plant origin that in recent years have been placed in this genus.

That group of species typified by Bacterium globiforme Conn is recognized as constituting the genus Arthrobacter Conn and Dimmick. The following characteristics of the genus Arthrobacter differentiate it from the genus Corynebacterium: growth on synthetic media, hydrolysis of gelatin and casein, slight or no acid production in dextrose nutrient broth (dextrose and several other carbohydrates are utilized), optimum growth temperature 30 to 33° C., sometimes motile.

The genus Jensenia Bisset and Moore, described by its authors to accommodate the soil diphtheroids, has been found closely related to, if not identical with, Nocardia Trevisan. Jensenia is not a synonym of Arthrobacter. The following characteristics of Jensenia differentiate it from Arthrobacter: micro-colonies on agar show an early open mycelium; does not hydrolyze starch or proteins; does not reduce nitrates.

Corynebacterium fimi (McBeth and Scales) Jensen, together with a group of closely related species such as Bacillus biazoteus Kellerman et.al. placed in the genus Cellulomonas by Bergey et. al. are retained in Cellulomonas. This genus is emended in re-

cognition of its close relationship to Corynebacterium. The type species is Cellulomonas biazotea (Kellerman) Bergey et.al. The following characteristics of Cellulomonas differentiate it from Arthrobacter; distinct acid production in dextrose nutrient broth; commonly cellulolytic; scant or no growth in synthetic media.

Several species of phytopathogenic corynebacteria, previously placed in such genera as Aplanobacter, Bacterium, Phytomonas, or Pseudomonas, none of which are tenable for this group, currently are left in Corynebacterium. Nevertheless it is believed that they should be segregated from Corynebacterium. Their actual transfer to a more satisfactory genus is left to those especially familiar with the phytopathogenic bacteria.

The genera Corynebacterium, Arthrobacter, and Cellulomonas are placed in the family Corynebacteriaceae and in the order Mycobacteriales. Objection is made to inclusion of the Corynebacteriaceae in the order Eubacteriales.

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